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HARDWARE

Caching Controllers: Is the Power Worth the Price?

FIRST LOOKS

Lotus 1-2-3/G Adds Graphics, Gobbles RAM

SOFTWARE

14 DOS Shells: Can Anything Compete With PC Tools 6.0?

LAB NOTES

Inside EISA: A Guided Tour of the Other 32-Bit Bus

JUNE 12, 1990 THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING VOLUME 9 NUMBER 11

$1000 LASER PRINTERS

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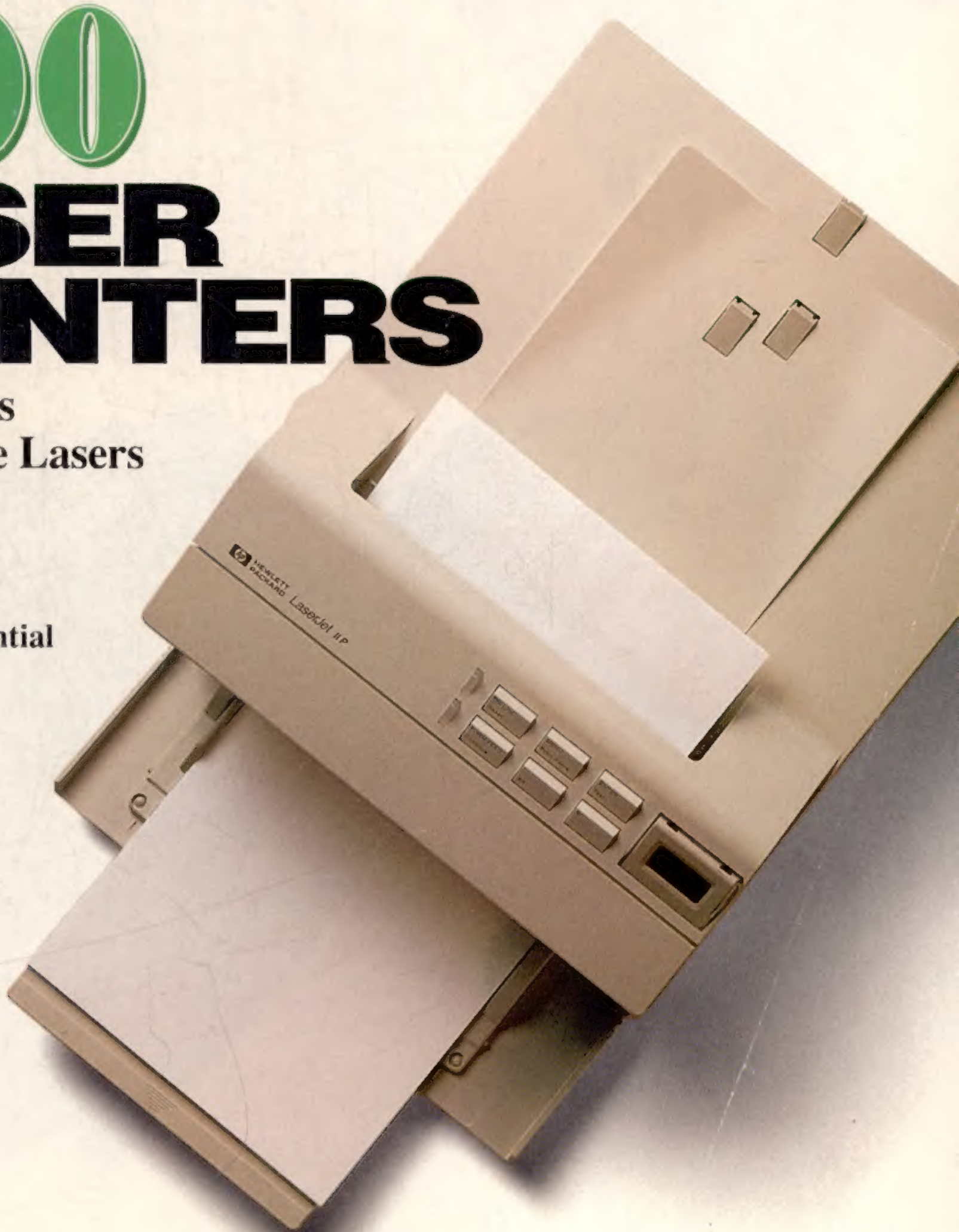

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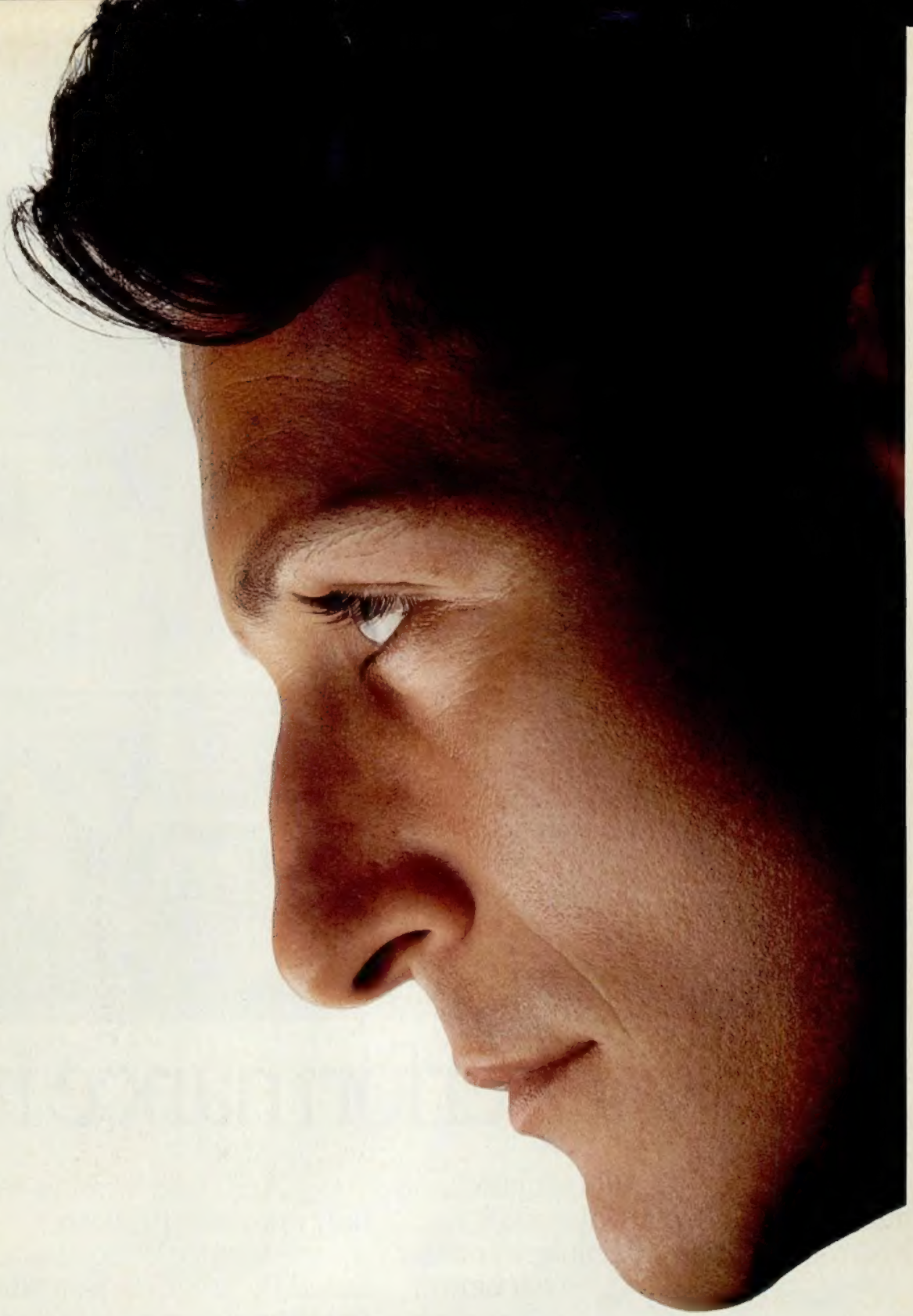

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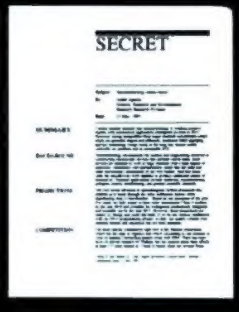

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Inside

Not long ago, if you wanted to read a book about personal computing, you had two choices: Peter Norton's *Inside the IBM PC* or Ray Duncan's *Advanced MS-DOS*. Sure, you could find dozens of books that had been rushed into print to capitalize on the PC's growth. But by and large, those tomes were little more than rewritten software manuals, useful mainly to those who stole their software.

Recently, books about computing have reached a new level of maturity. There are still plenty of rush jobs trying to succeed on the coattails of a popular application, but there's also a growing library of really useful writing.

To help you sort among the winners and losers out there, we're starting a book review column, appropriately dubbed "Read Only," in this issue.

In the debut column, staff editor Lori Grunin's choices cover two distinct fields: printers and data exchange. Read Only will try to round up all of the new books in a certain category. On occasion, Lori will devote more space to those rare books that promise to provide insight into our understanding of computers. Most times, though, Lori will be providing critical looks at nuts-and-bolts issues, ensuring that the reviews are concise and informative in the best *PC Magazine* spirit.

Lori Grunin, otherwise known as The PC Advisor, will be scouting books for Read Only.

Elsewhere in the issue, we apply that spirit to inexpensive laser printers, hard disk controllers with internal caches, remote-control software, and DOS Shells. And, in PC Lab Notes, Winn Rosch, author of *The Winn Rosch Hardware Bible*, puts the higher data-transfer rates and arbitration protocols of the new EISA bus into perspective. Finally, we're adding a few more names to the roster of contributing editors. Five writers whose work appears frequently in the magazine are being recognized for their valuable, continuing efforts.

The five are: Doug Boling, an electrical engineer and author of the magazine's EMS40.SYS utility; Bruce Brown, a computer consultant who has written dozens of PC reviews; Mitt Jones, a former senior editor at the magazine who wrote the PC Advisor column from mid-1987 through mid-1988; Barry Simon, a math professor at the California Institute of Technology, who tested math toolboxes in our last issue; and Craig Stinson, the author of the magazine's Spreadsheets column in the Productivity section.

PC Magazine's contributing editors do more than contribute articles; they form an informal advisory board, which helps the regular editorial staff evaluate article ideas and test criteria. We're looking forward to publishing more fine work from all of them, and to getting more of their sound opinions.—**Gus Venditto** ■

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Jim Seymour - PC Magazine

The QMS-PS 810

The QMS-PS 820

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PC MAGAZINE

June 12, 1990

Volume 9 Number 11

UP FRONT

4 **INSIDE**

15 **LETTERS**

27 **ADVISOR**
Lori Grunin/ CGM utilities; more large-system equation solving; a reader's thoughts on VHS and S-VHS.

33 **FIRST LOOKS**
RAM-hungry ***1-2-3/G*** for the OS/2 Presentation Manager retains the familiar keyboard interface and adds new solving capabilities.
Sharp PC-6220 packs a paper-white VGA display, a 20MB hard disk, and a 12-MHz 80C286 processor in a 4-pound package.
Control Room: Do-everything utility makes configuring and surveying systems a snap.
Stowaway 2400: Pocket-sized modem for laptops draws its power from the telephone line.

53 **NEW AND IMPROVED**
Matthew J. Ross

61 **READ ONLY**
Lori Grunin

63 **PIPELINE**
Gus Venditto

69 **BILL MACHRONE**
Old Advice: The Best Advice

75 **JOHN C. DVORAK**
The Software Slop Factor

77 **Inside Track**

81 **JIM SEYMOUR**
Software That Leaves Our Needs Behind

89 **WILLIAM F. ZACHMANN**
The Real-World Problems with Unix

COVER STORY

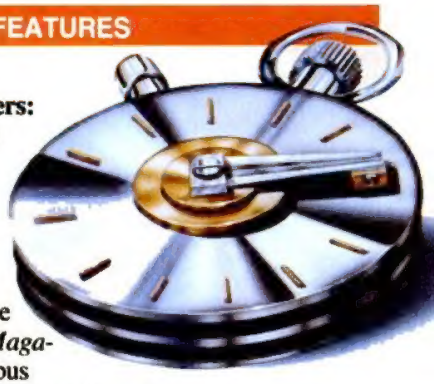
113 **LASER PRINTERS**
A $1,000 Laser for Every Desktop
John Dickinson/ Last year, the Hewlett-Packard LaserJet IIP turned the $1,000 laser printer into reality. Now, eight competitors offer lasers at roughly the same price.

115 **HP LaserJet III: The Low-End Laser to Beat**
116 **Editor's Choice**
142 **Hot Off the Assembly Line: IBM's Auspicious Answer to the Low-Cost Laser**

126 Canon LBP-4
126 Dataproducts LZR 650
128 Epson EPL-6000
133 Facit P6060
134 Fujitsu RX7100
139 Hewlett-Packard LaserJet IIP
140 Okidata OkiLaser 400
143 Qume CrystalPrint Series II
146 Toshiba PageLaser6

120 **How to Read the Fonts & Features Table**
122 **How to Read the Printer Guide**
122 **PC Magazine Guide: Inexpensive Laser Printers**

FEATURES



153 **HARDWARE**
Caching Controllers: Hard Disk Access In No Time Flat
Alfred Poor/ Caching disk controllers will boost your computer's performance significantly. *PC Magazine* tests four AT-bus caching cards for the ESDI interface.

156 **How a Disk Cache Works**
159 **Editor's Choice**
170 **Data on the Fast Track: Disk Caching Approaches**

162 CompuAdd HardCache/ESDI
168 DPT SmartCache Controller
173 Konan TenTime TNT-2210
174 Perceptive Solutions hyperSTORE-1600

174 **How We Tested Caching Disk Controllers**
175 **Performance Tests**
180 **Features Table**

FEATURES

185 SOFTWARE
Playing the DOS Shell Game
Bruce Brown/ Whether you're a PC novice or a power user, one of these 14 programs has a set of file and disk management features to help you compute better and faster.

198 Which DOS Shells Are Ready for the Road?
214 The DOS Shell You'll Find in DOS
218 Lotus Magellan: The Ultimate DOS Shell?
188 Editor's Choice
206 Features Table

245 ENDURANCE TESTS
PC Magazine Endurance Tests: Scanners and Printers *Jennifer Zaino/* Nineteen scanners and printers are challenged to meet the demands of daily use.

246 Chinon DS-3000
246 Hewlett-Packard ScanJet Plus
249 Kurzweil K-5100 Intelligent Scanning System
249 Brother HL-8e
256 Brother HL-8PS
256 Hewlett-Packard LaserJet IID
258 Hewlett-Packard LaserJet IIP
265 IBM LaserPrinter
265 QMS PS-2200 Model S
265 Varityper VT600W
266 QMS ColorScript 100 Model 10
270 Hewlett-Packard DeskJet Plus
270 AEG Olympia NP 136-24
273 IBM Proprinter XL24E
274 NEC Pinwriter P2200XE
274 Panasonic KX-P1124
275 Unisys AP 1324
276 C. Itoh C-610
282 Star Micronics XB-2415 Multi-Font

295 COMMUNICATIONS
The Next Best Thing to Being There *Mike Byrd/* Having access to your PC when you're a phone line away from the office can make or break your business.

296 Editor's Choice
297 Features Table
302 Performance Tests

296 BLAST RemoteControl
297 Carbon Copy Plus
299 Close-Up
301 Co/Session
301 pcAnywhere III
306 Remote²
306 Takeover

397 Direct Marketing Connection
409 Reader Service Card
420 Marketplace
447 Editorial Product Index
448 Advertisers' Product Index
450 Coming Up
456 Index to Advertisers

PRODUCTIVITY

315 LAB NOTES
The New EISA Standard: Did IBM Miss the Bus? *Winn L Rosch*

329 UTILITIES
Getting a Good Look at How DOS Allocates Your Memory Blocks *Earl F. Glynn*

347 ENVIRONMENTS
Programming for Multithreaded Drawing, Part 2 *Charles Petzold*

359 POWER PROGRAMMING
Explore the Depths and Impact of OS/2's 32-Bit API *Ray Duncan*

367 WINDOWS
William S. Hall/ Using TSRs under *Microsoft Windows;* exploring *Windows'* Multiple Document Interface.

371 DATABASES
Trudy Neuhaus/ Clipper's UDFs can extend the power of Label or Report Forms.

375 SPREADSHEETS
Craig Stinson/ Outfit your *Lotus 1-2-3* footers and headers with not only the date but the time as well.

378 THE WORKING WORD
Craig L. Stark/ A *WordPerfect* add-in for users who prefer a command-driven interface.

381 USER-TO-USER
Neil J. Rubenking/ Find out what day a date falls on; make ANSI commands easier to use in batch files.

383 TUTOR
Jeff Prosise/ How to import *AutoCAD* graphics into *WordPerfect;* writing intelligent TSRs.

395 CONNECTIVITY
Frank J. Derfler, Jr./ A puzzling communications problem; shells and menus aid in managing a network.

AFTER HOURS

451 ■ *Crime Wave* ■ *Qix* ■ *Hole-in-One Miniature Golf* ■ *Knights of Legend* ■ *Health Database Plus*

458 ABORT, RETRY, FAIL?
Bill Howard

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PC MAGAZINE
EDITOR'S CHOICE
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Computer Shopper, April 1990 Issue

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PC Magazine, United Kingdom, Editor's Choice Review

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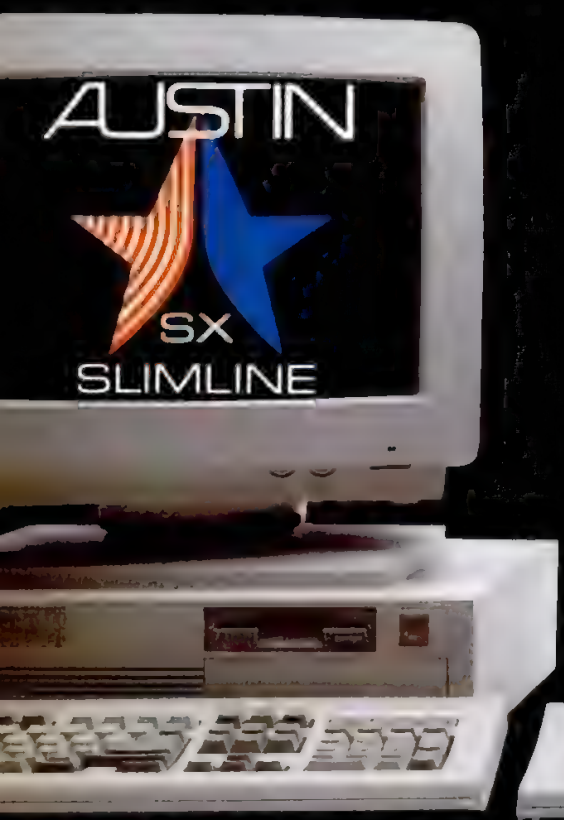

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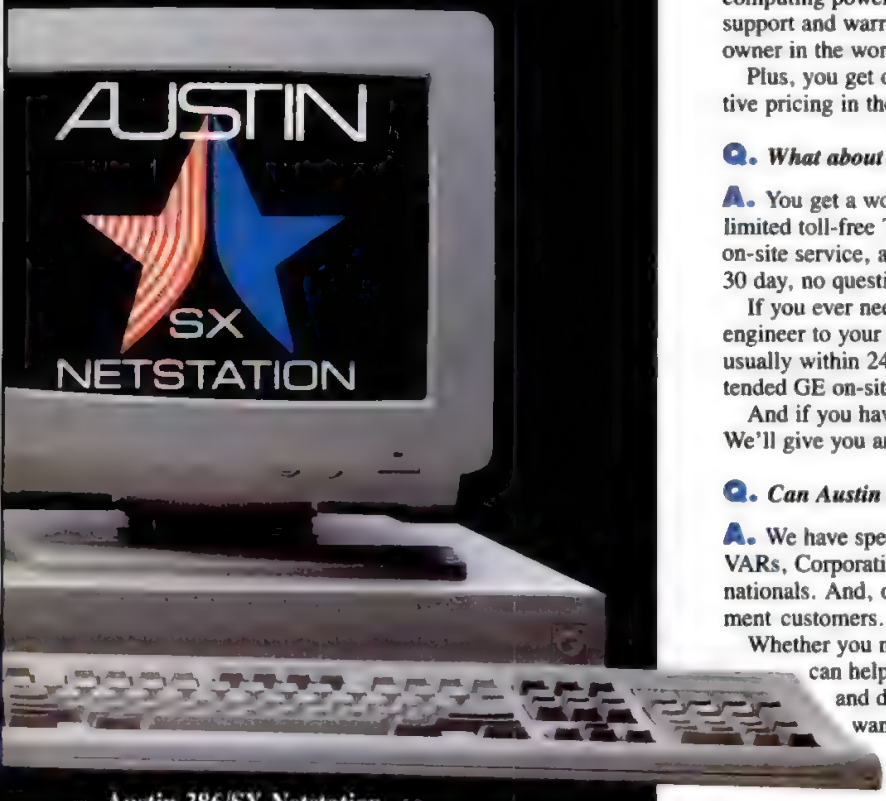

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	80 MB	$2295	$2295	$2995	$3795
	110 MB	$2395	$2395	$3075	$3895
	175 MB	$2895	$2895	$3495	$4295
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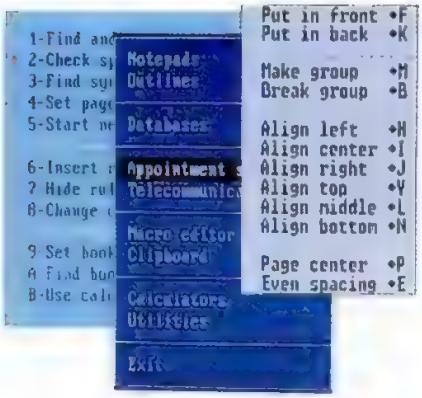

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Over to word processing for a quick memo. Into your spreadsheet for budget work. Off to your database for a mailing list update. Return to your word processor, and it's ready to go back to work, right where you left off.

Or load several sessions of the same program, each with a different file, pop back and forth, and work on several spreadsheets, documents, or anything else, all at once.

Why didn't someone do this before?

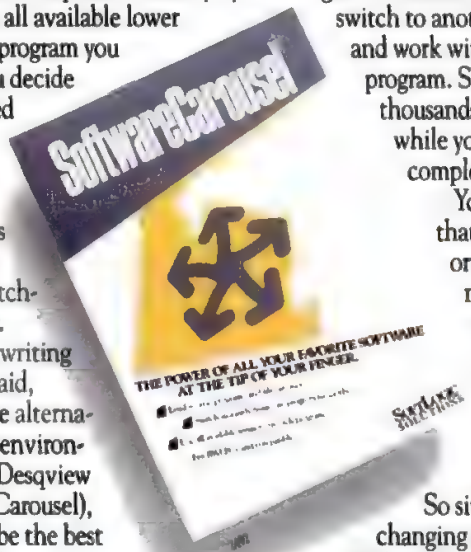
Actually, a lot of people tried. But what they ended with were a bunch of fancy software "environments" that eat up memory, change the way you work, and boggle the mind with complexity.

Plus, a lot of them make you buy new "compatible" software applications. Some even make you buy a bigger computer.

Software Carousel, on the other hand, works with the programs you already own. So you can go on using 1-2-3, WordPerfect, dBASE, SideKick, any program that runs on the computer you use right now. In an absolute minimum of memory. Without changing anything about the way your software runs.

Best of all, Software Carousel makes the most of your computer's memory by letting you use all available lower RAM in each program you use. And if you decide to add extended or expanded memory, Software Carousel works with that too, and makes switching even faster.

Garry Ray, writing for PC Week said, "Of these three alternative operating environments (OS/2, Desqview and Software Carousel), Carousel may be the best choice of the day."



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#6

Letters

COMPUTERPHOBICS UNITE

John Dvorak correctly identifies two major sources of computerphobia in his March 13, 1990, column in *PC Magazine*: the fear of humiliation and the fear of doing damage. Using the computer as more than a typewriter requires an agile abstract intelligence; most computer learning is based on learning abstract rules, which one must figure out how to apply. People whose thinking styles are either more concrete or more impressionistic are rightly anxious when they begin working with computers.

I believe there is an important niche in the computer industry for trainers, educators, and consultants who are technically competent but whose main expertise is psychological. Dvorak is right: computerphobia is a serious problem, and one that won't be well addressed without psychological acumen.

Robert T. Fancher
New Rochelle, New York

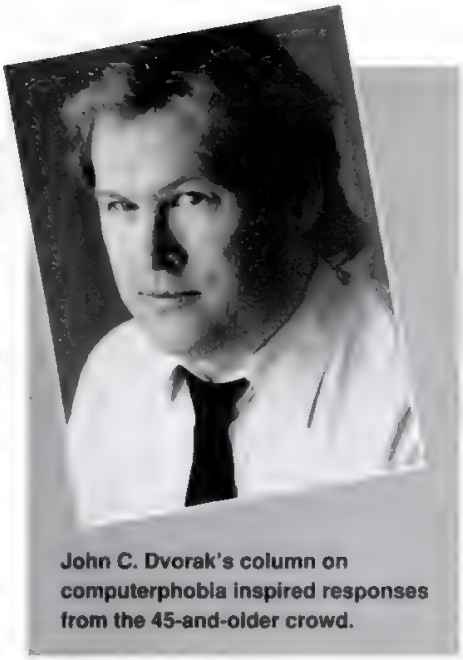
The "45-and-older" crowd that seems to be so uncomfortable with computers may simply be experiencing the effects of culture shock—a disorientation that results when one's cultural patterns have no meaning in the new culture. Perhaps as the cultural patterns around them have changed, they have retreated back into their old, familiar lifestyles.

Tom Kelley
Memphis, Tennessee

John C. Dvorak's computerphobia article about the 45-and-older crowd brought back fond memories of conversations with my eldest son in the late '60s. He believed that the brain died at age 30.

Now, at the age of 42, as a practicing M.D. and the father of three sons, his outlook has undergone a remarkable transformation. I'll bet that Mr. Dvorak will likewise grow into wisdom with the passage of years.

Richard Huddleston
Houston, Texas



John C. Dvorak's column on computerphobia inspired responses from the 45-and-older crowd.

What is this claptrap about computerphobia hovering around the over-45-crowd? Let's hear it for those computerphiles who have crossed that dreaded age barrier and found that we did not suddenly grow yellow stripes down the middle of our backs!

I have been in the systems development business for 22 years, having embarked on a career in that dreaded field, then called "data processing," and I have met computerphobes of all ages!

What the world does not need is more stereotypes!

Marianne K. Mickela
Stoughton, Massachusetts

INDEXING REVIEWS

As a current subscriber (for the past five years!), I'd like to ask a small favor. Do you print a cumulative index? I don't remember seeing one.

Walter George
San Francisco, California

Your magazine is terrific, but I have a suggestion: When rewarding subscribers, stop sending diskettes full of cute utilities that rarely get used. Instead, send something we really need: a simple database that summarizes your product reviews.

I can't be your only reader who regularly hauls 20 pounds of *PC Magazines* out to the recycling bin for lack of space. I hate doing it, because the product reviews are invaluable.

Chris Butler
Campell, California

Both an index to *PC Magazine* and a database of reviews are available through our on-line service, PC MagNet. A down-loadable index can be found in the Utilities section of PC Magnet, while an index of reviews is available under the main menu. In addition, readers can access Computer Database Plus, which offers full text from 130 different publications. This is a surcharge database, costing $24 per hour plus hit charges in addition to the PC Magnet cost of $12.50 per hour.—*Ed.*

PUTTING IN A GOOD WORD

I hope you give *Microsoft Word for Windows* another hearing soon. Your review (First Looks, *PC Magazine*, February 13, 1990,) missed several highlights of the program. In noting that clippings from *Excel* spreadsheets can be imported as tables, you neglect the exciting use of tables within the program.

Another point is overlooked when you described the draft mode as "ugly but fast." Many new *Word for Windows* users have told me they do not like to see the *Windows* screen fonts during document creation. This is because a VGA display appears fuzzy and slow to someone used to DOS character-based applications. The Draft View uses a single, clear screen font, and graphic images are replaced by empty boxes. This lets users concentrate on writing and worry about viewing fonts and graphic images later.

David Dean
Contributing Editor
PC Publishing Magazine
New York, New York

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Letters

EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT LANS

I just wanted to offer kudos to Pete Maclean for his Lab Notes, "Extending the Local Area Network to the Laptop Computer," and Frank Derfler for his Connectivity column in your March 13, 1990, issue. Both articles were great.

We use a lot of this equipment at work, and I've always wondered how it all fit together and what else was possible. The half-hour I spent reading those two columns was the most useful reading I've done in weeks.

Annette Napoli
Houston, Texas

WORDS FOR ZACHMANN

While William F. Zachmann's column of February 13th brings up some interesting points, it fails to tell how a PC-based system will be able to replace a mainframe with hundreds of users simultaneously accessing an OLTP (on-line transaction processing) application updating a large central database.

The needs of some corporations cannot be met by local PC networks with yesterday's database, or even last hour's database. These functions are, and will be, best served by a custom application running on a mainframe.

What micros do offer, though, is a replacement for smaller systems, especially minicomputers.

Bruce Grembowski
Los Gatos, California

I wish to take issue with William F. Zachmann's continuous shilling for OS/2 since it is becoming obvious to even the most casual observer that the failing OS/2 is fundamentally and profoundly flawed to its core.

The most damaging OS/2 flaw is the bid to strike out (pun intended) in a new direction: the failure to make OS/2 a compatible extension of DOS. The masses are not going to trash their DOS applications for the sake of an operating system—and that doesn't mean just the majors like spreadsheets, word processors, desktop publishing programs, and the like, but all the little games, shareware, utilities, and dinky .COM and .EXE files that make up the environment.

Extending operating environments so that present applications will still run is a time-honored tradition in data processing, and it was pure pomposity on the part of the Microsoft/IBM cabal to believe that they didn't have to follow this tradition. They didn't have to do it like this; with software you can do anything, and that includes extending DOS.

By the middle of the '90s, OS/2 will have achieved a status comparable to CP/M today, and its death will be unmourned.

Jeffrey Fiala
Brookfield, Illinois

WHAT PRICE INTEGRATED SOFTWARE?

I enjoyed your very thorough article on low-cost integrated software ("Integrated Software Gets It Together," *PC Magazine*, December 26, 1989). However, I disagree with your judgment call on *Integrated 7 Advanced*.

You need to amplify the information about the market price of the tested software. *Integrated 7 Advanced*, *Microsoft Works*, and *PFS:First Choice* all sell at discounted prices in the $90 to $100 range. *Better Working Eight-in-One* discounts to about $40. At least six of the seven reviewed packages are available for under $100. So calling *Integrated 7* the most expensive of the group is somewhat moot.

Alan C. Smith
Apo, New York

UTILITY TO THE RESCUE

We finally used one of the utilities listed in *PC Magazine* ("PCRemote," Utilities, January 16, 1990), and it was exceptional!

Last week a client, the Major Indoor Soccer League (MISL), had a problem with the *FoxBASE* database files used to maintain individual and team season stats. Previously we would have either transferred files or sent the disks back to the vendor to check and repair the problem.

Instead I logged onto PC MagNet, downloaded PCRemote, transferred a copy to the MISL, and used PCRemote to run the league's computer from our office just as if I were at its keyboard. Exactly as described, we were able to run our client's version of *FoxBASE*, edit the files, and within 30 minutes repaired the problem.

Thank you for PCRemote, and keep up the good work.

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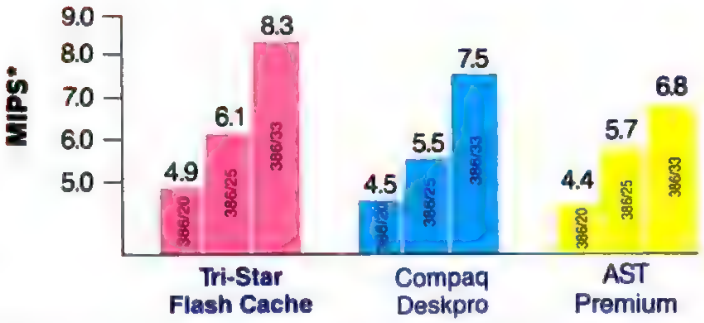

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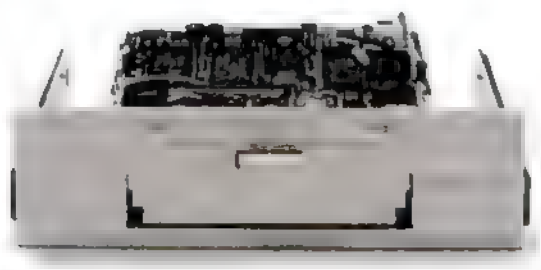

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It follows the popular QIC-40 standard to support interchangeability of QIC-40 tapes. It formats cartridges while running other applications. It offers flexible backup and restore methods—all with built-in ECC and Reed Solomon error correction. It's even Novell®compatible, with an optional driver.

And best of all, it's fast. So fast PC Magazine ranked it number one among QIC-40 machines and awarded it Editors' Choice.

Are you ready for an historic development in tape backup? Call 1-800-821-0806 for the name of your nearest Everex Reseller.

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CIRCLE 216 ON READER SERVICE CARD

Letters

A PLEA FOR SURGE PROTECTION

Normally, I can rely on *PC Magazine* for good performance reviews on all major brands of computer equipment, components, and peripherals. Unfortunately, in the two years of back issues I have sitting on my office shelves, I have been unable to find a single review of power-conditioning equipment. This equipment is vital to the regular operation of PCs and peripherals, yet you refuse to recognize its importance.

Having spent the last several weeks trying to deal with different manufacturers claiming that theirs is the only true surge-suppression device, uninterruptible power supply, or standby power supply, I could use some help. I know it's boring. But it is not as boring as watching your $4,500 laser printer sitting there unused because it was severely damaged due to inferior power-conditioning equipment.

Pete C. Wilson
Fort Wayne, Indiana

PC Magazine recognizes the importance of protecting your computer equipment, and we will be featuring an in-depth look at power conditioning equipment in one of the fall issues this year.

GUIs AND LITERACY

In response to the letter from John Boots (Letters, *PC Magazine*, February 13, 1990), GUIs are here to stay! The form that literacy is taking is changing with the technologies that are prevailing in our society.

We are a nation that has been weaned on remote, baptized by Nintendo, and soon to be confirmed by camcorders. As a remedial education specialist with 15 years of teaching experience and an enthusiast for computer-based instruction, I applaud the use of GUIs as an innovation that enhances the learning process.

Educational software packages that incorporate GUIs are encouraging our students to learn through their generation's medium. Perhaps one so opposed to graphical user interfaces would prefer hieroglyphics, another form of communication that also incorporates silicon-based icons.

Janice Nazarewicz
Worcester, Massachusetts

LOTUS AND OS/2

We would be pleased if you would explain a statement made by Richard Hale Shaw in the February 27, 1990 article, "*Excel* for OS/2: A New Home for an Old Favorite."

In his article he states, "We found that when we switched to its full-screen session under OS/2 1.2, *1-2-3* (Release 3) consistently crashed." This statement requires clarification.

Immediately prior to the release of OS/2 1.2 in September 1989, Lotus learned of a change in the operating system code between versions 1.1 and 1.2 of OS/2. Since *1-2-3* Release 3 had shipped prior to OS/2 1.2, this change rendered Release 3 display drivers incompatible with the new version, OS/2 1.2.

Lotus immediately offered its customers a solution to the problem by providing an update to the Release 3 Display Drivers disk for OS/2 1.2. This disk may be obtained, free of charge, by contacting Lotus Customer Service at (800) 345-1043.

Paul McNulty
Director of Marketing, *1-2-3* Release 3
Lotus Development Corp.
Cambridge, Massachusetts

PC Magazine tested *Lotus 1-2-3* Release 3 for the "*Excel* for OS/2" article using the package Lotus shipped us in mid-October, 1989. It included neither an updated version of the software on the disks nor an upgrade notification. Nor were the support personnel we talked to able to answer why we had a problem when we brought it to their attention.—*Richard Hale Shaw*

CORRECTIONS & AMPLIFICATIONS

In our review of 33-MHz 386 PCs ("Speed to Burn: 22 of the Fastest 386s," February 13, 1990) the PC Craft 5000/33C was tested with all but 512K RAM of its DPT hard disk controller's 4.5 MB RAM disabled. The adjusted price for the tested configuration is $10,150.

HOW TO WRITE TO PC MAGAZINE

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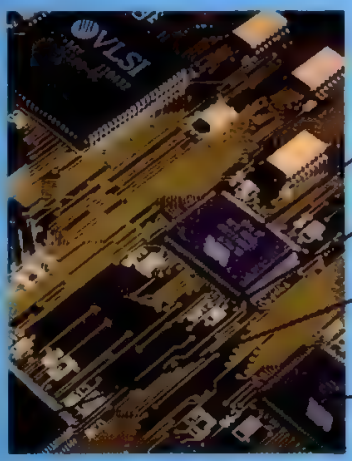

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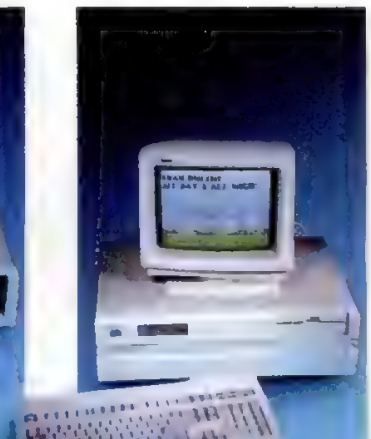

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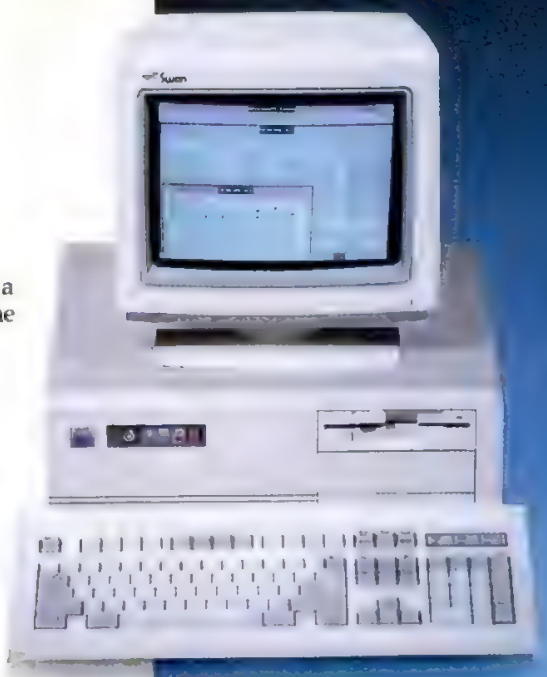

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InfoWorld, February 26, 1990

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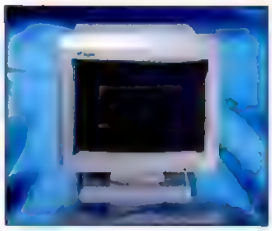

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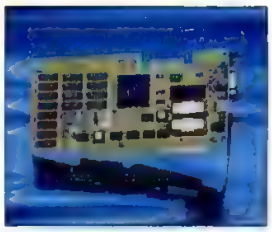

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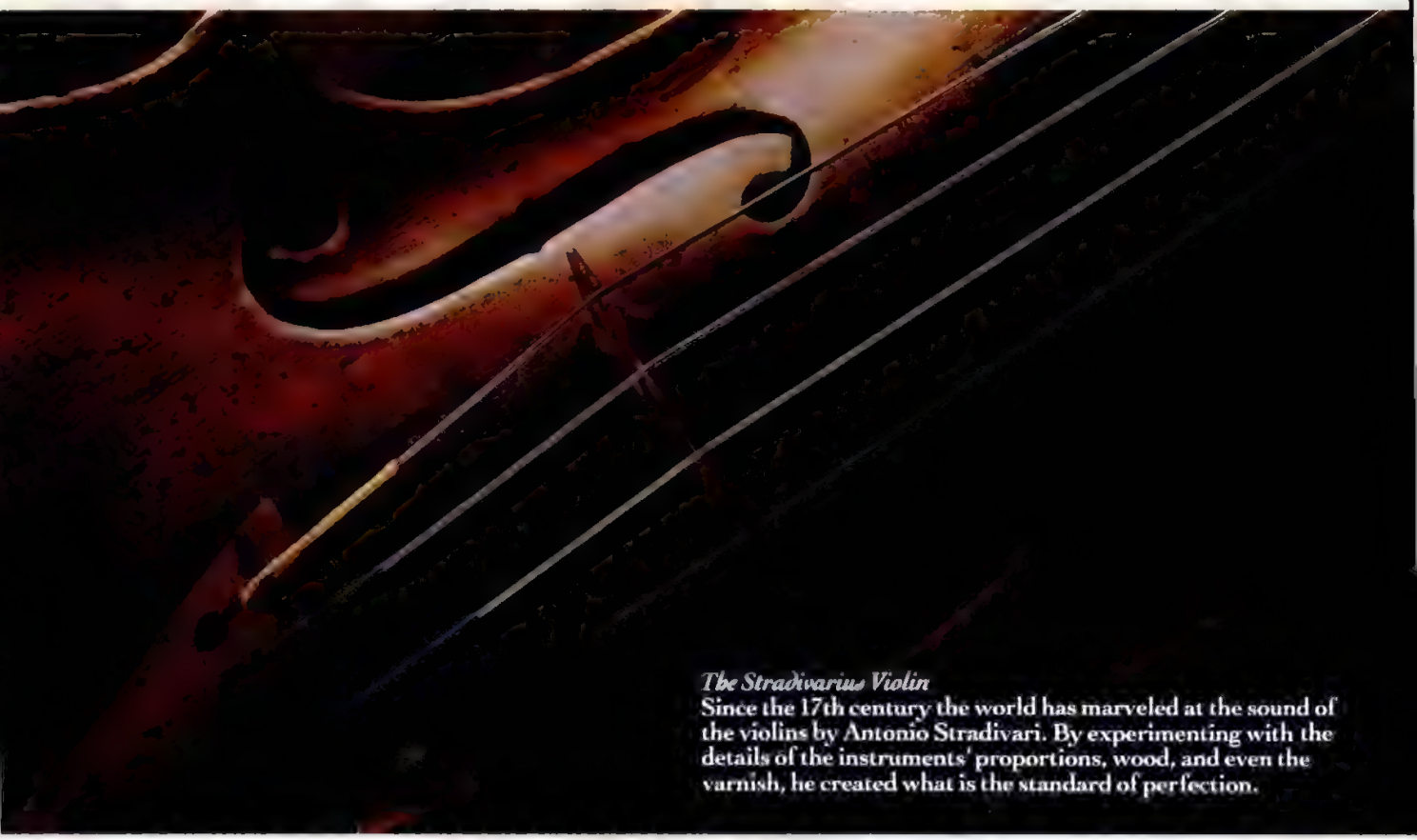

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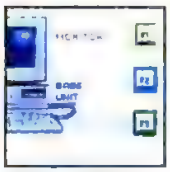

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by Lori Grunin

Advisor

- METAFILING: Utilities for .CGM users and programmers.
- BEATING THE SYSTEMS: More ways to solve large systems of equations.
- ADVISING THE ADVISOR: A reader clears up some misconceptions about VHS and S-VHS.

METAFILING

Your information regarding the .PCX format in the December 12, 1989, issue was very informative. Do you also have a source regarding the .CGM format?

Jim Smith
Forest Lake, Minnesota

Unlike the .PCX graphics format, which is a de facto standard because of its widespread use, the Computer Graphics Metafile (CGM) format is ratified by the American National Standards Institute (ANSI); specifically, it's the ANSI X3.122-1986 standard. Hence, the specifications are available for $45 from ANSI (1430 Broadway, New York, NY 10018; (212) 642-4900).

If you're a programmer searching for .CGM-related utilities and subroutines, one company to get in touch with is Graphic Software Systems Inc., a.k.a. GSS (9590 SW Gemini Dr., Beaverton, OR 97005; (503) 641-2200). GSS sells the *CGM Interpreter* ($395), a linkable subroutine library whose functions include reading, interpreting, modifying, and redrawing .CGM files.

On the other hand, if you're just looking to convert .CGM-format files to other formats, there are a few packages at your disposal. Zenographics's *ImPort* ($295) is the most general, converting from .CGM to .PIC, .DXF, .IMA *(Mirage)*, and HPGL files. (Zenographics, 19752 MacArthur Blvd., #250, Irvine, CA 92715; (714) 851-6352.) The company also offers *Plus* versions of *ImPort*, one of which supports the HP PaintJet XL, as well as Targa and TIFF input files ($395). A *Microsoft Windows*-specific version should be out by the time you read this.

Kinetic Software's *CADConvert* ($100) is more limited, only converting .DXF files to .CGM. (Kinetic Software, 240 Distillery Commons, Louisville, KY 40206; (502) 583-1679.)

And last, Digital Research offers a series of *Filter Packs* ($15 per pack), one of which converts .CGM files into a *GEM*-compatible format. (Digital Research, 70 Garden Ct., Monterey, CA 93942; (800) 443-4200, (408) 649-3896.)

BEATING THE SYSTEMS

Few engineers or scientists would attempt to use the type of software your February 27, 1990, Advisor column suggests to solve large-scale systems of equations. *Derive* and *Mathematica* have excellent symbolic capabilities, but the idea of a practical symbolic solution of a general system of 25 equations with 25 unknowns is quite unrealistic.

As you indicate, a principal difficulty in the numerical solution of large linear (and nonlinear) systems is the accumulation of round-off errors that can swamp the solution being sought. Two decades of work by leading numerical analysts led to the development of the well-known mainframe packages LINPACK and EISPACK for the reliable solution of large linear systems. The best MS-DOS implementation of these techniques is *PC-Matlab*, which permits the numerical solution of a 90 by 90 linear system on an 8088 machine (and also includes nonlinear methods).

The current release, Version 3.5, includes an 80286 version that breaks the 640K barrier by using 1MB of extended memory to run in protected mode. There is also a *386-Matlab* version that has no limits on matrix or workspace size (subject to available memory), and hence allows mainframe-size problems to be solved.

All versions of *Matlab* require a numeric coprocessor, and include excellent graphics in an interactive user environment that assumes little or no programming experience.

C.H. Edwards, Jr.
Athens, Georgia

Several readers popped out of the woodwork to offer suggestions on this one. *PC-Matlab* ($795) and *386-Matlab* ($1,495), a mathematical toolbox that stresses matrix operations, received the most nominations, and is certainly a viable alternative. We looked at the package in "Better Tools for Higher Math: When Numbers Count," in the March 14, 1989, issue of *PC Magazine* (the program is listed as *Matlab*, not *PC-Matlab*). (The MathWorks Inc., 21 Eliot St., South Natick, MA 01760; (508) 653-1415.)

Another reader chastised me for listing several very expensive solutions; he performs all of his matrix manipulations using a short BASIC program. Of course, you needn't confine yourself to BASIC—you can use almost any language, if you're inclined to program.

One language especially optimized for mathematical operations is APL (A Programming Language). Versions of APL range from IAPL Ltd.'s public domain APL interpreter (downloadable from either Data Library 4 of the Programming forum on PC MagNet or Data Library 5 of the IBMPRO forum on CompuServe, both under the filename IAPL11.ARC) to the full-blown *APL*Plus/PC* offered by STSC ($695; 2115 E. Jefferson St., Rockville, MD 20852; (800) 592-0050, (301) 984-5123), or *APL*Plus II* ($1,700), which runs on 386s.

ADVISING THE ADVISOR

The Advisor column in your January 16, 1990, issue answers a question about recording EGA or VGA output on a VCR. Although your reply ultimately sends the reader in the right direction, it also contains some misinformation.

The output from an EGA card is not, as you state, composite video—it is RGB (red-green-blue). CGA cards typically provide composite as well as RGB output, but the RCA-pin jacks on EGA cards are for the feature connector and do not carry any sort of video signal.

More serious, however, is your confusion about the nature of Super VHS. All that distinguishes S-VHS from regular VHS is the greater luminance bandwidth the system can record, which increases its horizontal resolution. Regardless of format, VCRs normally have both radio-frequency and composite-video inputs and outputs; any device that will work with a VHS VCR will work at least as well with an S-VHS VCR.

The explanation you give to the contrary appears to be based on a common misconception about the relationship between S-VHS and the S-Video (or Y/C) connectors commonly found on S-VHS, Hi8, and ED Beta VCRs. These connectors are not fundamental to any of these formats. They simply minimize a disadvantage in the way that a video signal is formatted for recording on consumer VCRs.

In a composite-video signal, the chrominance information is on a subcarrier near the top of the luminance baseband signal. Consumer VCRs lack the bandwidth necessary to record a composite-video signal directly (as on a laserdisk or a professional videotape recorder) without losing or mangling the color information. Instead, they separate the chrominance and transpose it down to a range of frequencies below what is used to record the luminance portion of the signal.

But unless an S-Video connector is used, the chrominance and luminance must be recombined into a composite-video signal for playback, and then the video monitor or television set must reseparate them on the way to assembling an RGB signal to drive the electron guns in its picture tube. S-Video connectors simply short-circuit this process, sending the luminance and chrominance signals directly from the VCR to the monitor, bypassing a cycle of merging and splitting that otherwise would be necessary. The visible benefit of using an S-Video connection usually ranges from very subtle to nonexistent. The superiority of S-VHS over regular VHS is fully apparent with an ordinary composite-video connection.

Michael Riggs
New York, New York

PC MAGAZINE I appreciate the lucid setting-straight on the video issues. We hope to present a similarly useful explication and evaluation of genlocking VGA to NTSC boards in a forthcoming issue of *PC Magazine*.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Ave., New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

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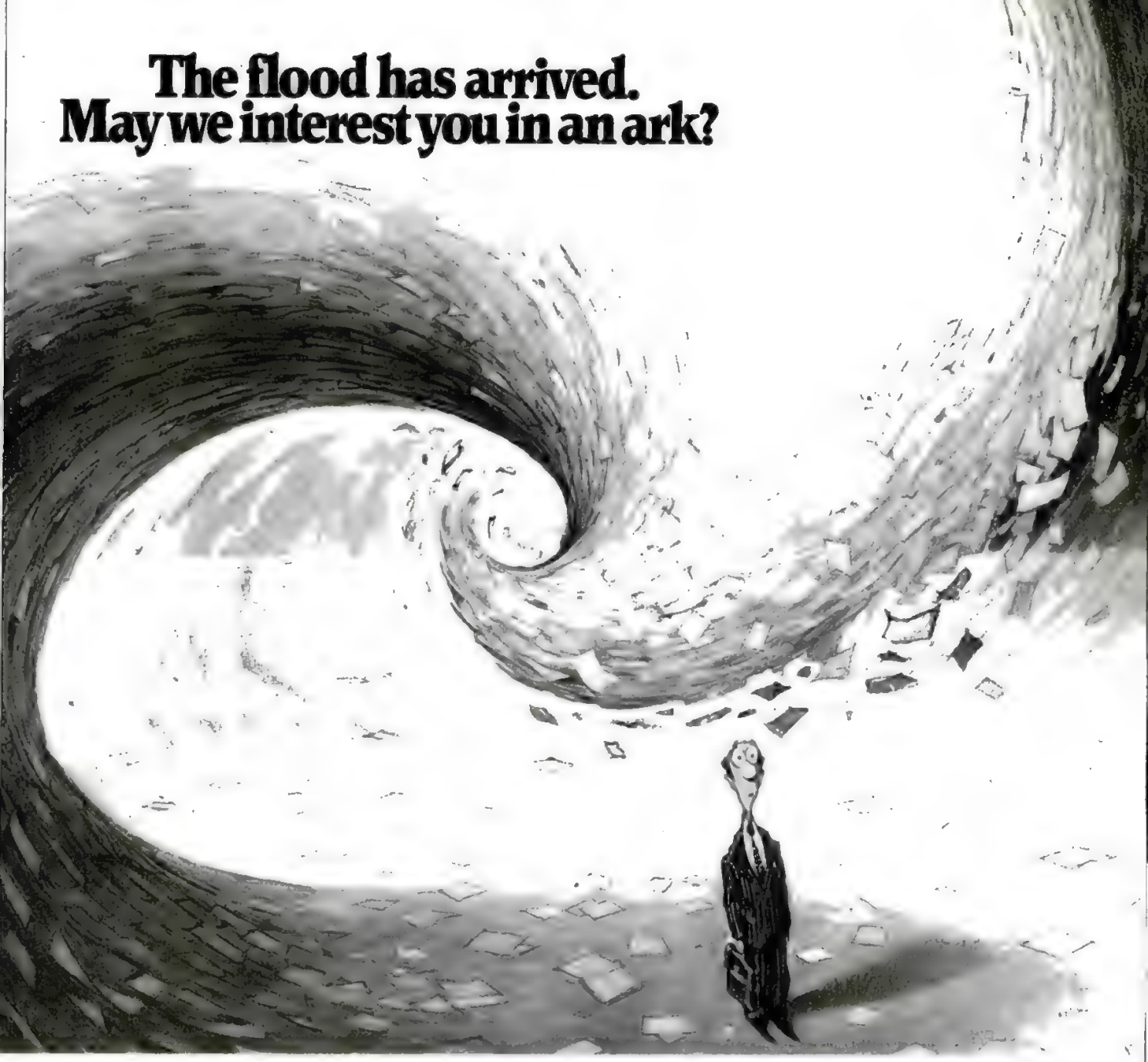

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PC Magazine, May 30, 1989

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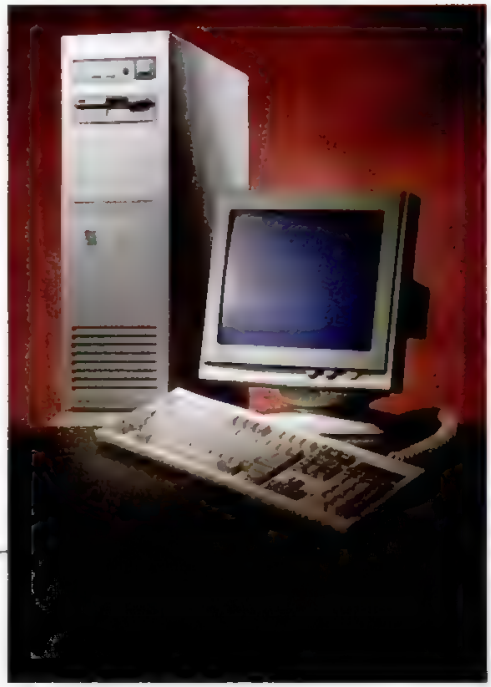

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CIRCLE 165 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

1-2-3/G: GUI-based Spreadsheet Retains Familiar Keyboard Interface, Adds Solver, And Eats RAM

HANDS ON
By Craig Gilbert

One reason the first Lotus spreadsheet took the world by storm in 1983 was that it totally redefined the spreadsheet genre. By incorporating graphics, rudimentary data-management capability, and a programming language into the framework of an electronic spreadsheet, the original *1-2-3* quickly overwhelmed the single-focus, once invincible, *Visicalc*.

The strategy behind Lotus Development Corp.'s newest spreadsheet for OS/2, *1-2-3/G*, shows interesting parallels with that first debut. Again Lotus is stepping into a market with an already well-established player, and again Lotus comes armed with something extra that takes its product well beyond the current definition of spreadsheet software.

The competition this time around is *Microsoft Excel*, which has had the market for graphical-environment spreadsheets all to itself for almost three years. The something extra Lotus has is a utility called the Solver, which performs linear and nonlinear optimization problems as a background thread while you work in the spreadsheet. The Solver is not the first optimization accessory for spreadsheets, but it's definitely easier to use and far more intelligent than anything seen before.

Along with the Solver, *1-2-3/G* also includes a goal-seeking tool called Backsolver. With Backsolver, you specify a target value in a particular cell

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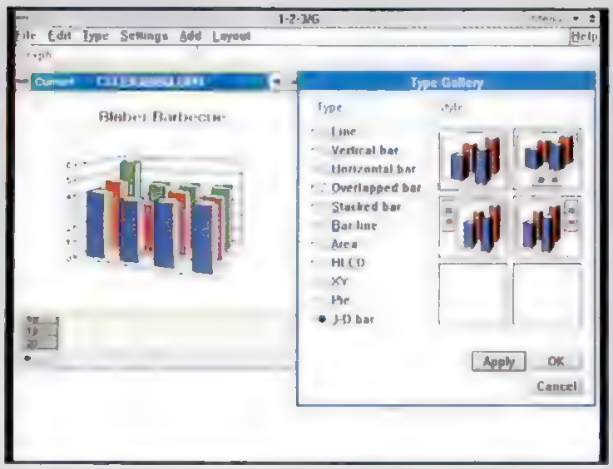


1-2-3/G's Graph tool features *Excel*-style gallery menus, which you can use to customize your graphs.

JUNE 12 REVIEW INDEX

Control Room
Custom TSR configures, surveys PCs 38

Applications Manager
Simplifies rule-based programming for PM . 43

dbPublisher for Ventura
Prints professional-quality data-intensive documents 46

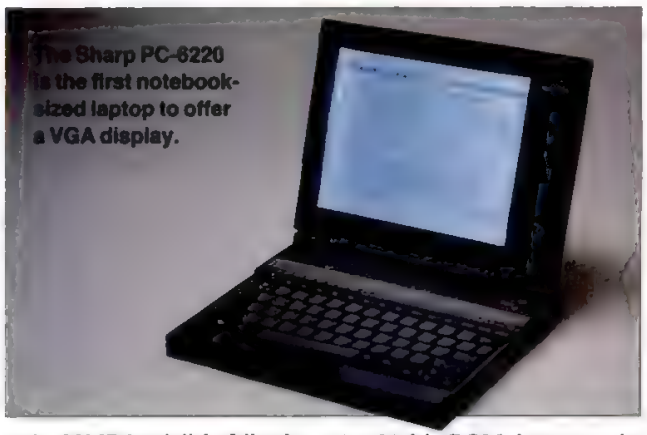
Stowaway 2400
Pocket-sized modem for laptops draws power from the telephone line 48

Sharp's PC-6220 Matches NEC's UltraLite in Size, Adds 286, Hard Disk, VGA Graphics

PREVIEW
By Mark Dennis

Since NEC pioneered the notebook laptop with its 4.4-pound UltraLite, each successive notebook laptop has grown a bit larger, and usually a bit heavier, than the one before it. In a welcome change of pace, Sharp Electronics is breaking the trend with its own 4.4-pound laptop. Best of all, the Sharp PC-6220 matches both the compact dimensions of the UltraLite—1.4 by 11 by 8.5 (HWD) inches—and the generous capabilities of the larger notebooks. It is also the first notebook laptop to sport a VGA display.

Scheduled to be available by the time you read this article, the PC-6220 will list at $3,995, a price that includes a 12-MHz 80C286 processor, 1MB RAM,



The Sharp PC-6220 is the first notebook-sized laptop to offer a VGA display.

and a 20MB hard disk. Like the UltraLite and the larger Toshiba T1000XE and T1200XE, the PC-6220 sacrifices the convenience of a floppy drive to help keep its size to a minimum. With 20MB of truly nonvolatile storage and a self-cloning version of Traveling Software's *LapLink* in ROM, however, the lack of a built-in floppy drive should not be a major problem for most users.

Chances are you'll find yourself hooked on the PC-6220 once you set eyes on its paper-white VGA display. Boasting a

CONTINUED ON PAGE 34

Sharp

CONTINUED FROM PAGE 33

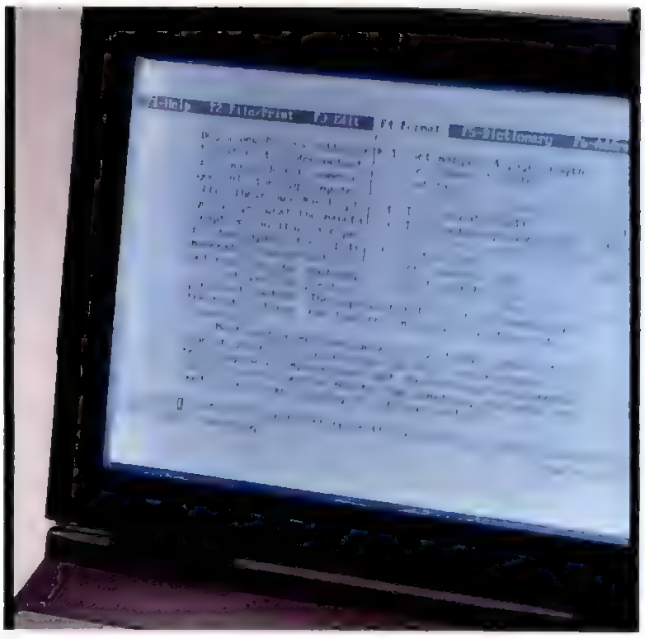
resolution of 640 by 480 and 16 shades of gray, the backlit display generates crisp, well-formed text and smooth VGA graphics. The screen measures a generous 8.8 inches wide by 5.9 high, for a diagonal measurement of about 10 inches. Ghosting was minimal on our preproduction evaluation unit, and the display did a wonderful job with a selection of .PIC files, emulating even tough color gradations smoothly.

While Sharp refers to the display as a triple supertwist LCD, a more accurate name would be film-compensated supertwist LCD. The function of the second layer of liquid crystal in a double supertwist nematic (DSTN) LCD is to compensate for the color of the liquid crystal itself, to render the display color closer to black and white than the blue or yellow-green of older supertwist displays. Instead of using more than one liquid crystal layer, Sharp placed a layer of thin plastic film on each side of the liquid crystal. The plastic film thus enables more light to pass through and is thinner than LC layers, allowing for a brighter, thinner screen. The film also produces a slight greenish tint, but the display looks close enough to black and white to warrant its paper-white label.

Like the CGA display of the Toshiba T1200XE, also wonderfully bright and thin, the Sharp's display is backlit from a fluorescent source at the edge of the screen. Fluorescent backlit screens typically consume less power and last longer than the EL-backlit screens used in the NEC UltraLite, the Toshiba T1000SE and T1000XE, and the Compaq LTE and LTE/286.

Display controls include a reverse-image switch as well as brightness and contrast controls. Both level controls allowed an exceptional range of adjustment on our evaluation unit.

If you've laid hands on an UltraLite, you know approximately what the keyboard of the PC-6220 feels like. Key travel is relatively short but easy to grow accustomed to. Even touch typists should have no problem. The layout is good, if not perfect, and also close to that of the UltraLite. Separate cursor-control keys lie in an inverted "T" formation at the bottom right corner, as they should. In following with many other laptop manufacturers, the Ins and Del keys lie in a rather inconvenient position on the top row toward the right.



The Sharp PC-6220's paper-white VGA display is backlit from a fluorescent source. Its 640 by 480 resolution and 16 shades of gray produce crisp text and smooth graphics.

Like the Toshiba T1000XE and T1200XE, the PC-6220 makes use of the tiny 2.5-inch hard disks manufactured by Conner Peripherals, JVC, and PrairieTek. Rated at 23 milliseconds, the PrairieTek disk in our evaluation unit operated virtually silently and without flaw.

Sharp rates the nickel cadmium battery pack in the PC-6220 for a life of up to 2 hours, a figure bound to disappoint some prospective buyers. Recharging requires approximately 2 hours. Unlike the battery cartridges of the Toshiba and Compaq notebook machines, you must disconnect the battery wires from a terminal to remove the Sharp's battery pack. This is no major task, but it does make the prospect of carrying extra batteries a bit less appealing.

As with every other notebook portable on the market, Sharp includes battery conservation utilities in ROM. In a nutshell, these utilities shut down specific components of the machine or put the entire machine in standby mode after set periods of inactivity. You can also put the machine in standby mode manually via a keyboard combination to save your current operating state for a later time. Unlike the Toshiba T1200XE with its power-off auto resume feature, there is no secondary battery to back up memory when the primary runs down. If you catch the battery in a low state before it runs down, however, a super capacitor inside the machine will power the memory state for about five minutes, long enough to allow you to plug in the AC adapter or swap out the battery.

The PC-6220 departs from the norm a bit with its standard ports, though not in a way likely to cause you much hardship. Instead of a standard parallel port, the PC-6220 comes with a tiny, micro D connector, which measures about 0.7 inches wide and 0.1 inch high. Standard equipment includes a small, two-ounce adapter that allows connection of a standard Centronics parallel cable. Fortunately, the serial connector is standard size, a fact you will appreciate when you attempt to use *LapLink*.

Sharp is offering a large assortment of internal and external options for the PC-6220, all of which are promised for shipment along with the machine.

For those who need plenty of memory, the PC-6220 accommodates two optional, 1MB memory modules for a total internal capacity of 3MB. Sharp has not yet set option prices but projects RAM upgrade price at $500 per module.

Another internal expansion compartment accepts either an external VGA adapter, projected at about $150, or a 2,400-bits-per-second modem/fax (send only) card, projected at $500.

The PC-6220 will also accommodate an 80C287 math coprocessor, a trick the Compaq LTE/286 can handle but the Toshiba T1200XE cannot.

For those who require additional battery life and don't want to carry replacements, Sharp will offer an optional, external battery pack good for 3.5 hours of additional charge. The external pack, which snaps on to the rear of the machine, adds about 1 pound 12 ounces to its weight and about two inches to its depth. Sharp projects the external battery pack price at

CONTINUED ON PAGE 36

PC MAGAZINE FACT FILE

Sharp PC-6220
Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430-2135; (201) 529-9500.
List Price: With 1MB RAM, 10-inch VGA display, 20MB hard disk, Traveling Software's *LapLink* in ROM, and DOS 4.01 or later, $3,995.
In Short: The 286-based Sharp PC-6220 manages to pack most of the features of the larger notebook laptops into a compact, 4.4-pound package. It is also the only notebook laptop to offer VGA graphics. Despite its 2-hour battery life and lack of floppy drive, it is unquestionably one of the hottest notebook laptops going.

CIRCLE 442 ON READER SERVICE CARD

First Looks

1-2-3/G

CONTINUED FROM PAGE 33

and an antecedent cell that can be varied to meet the target. The program performs the reiterative grunt work to come up with the proper antecedent value.

Unfortunately, though *1-2-3/G* may be the most compelling broad-based OS/2 application to date, the moving costs are still extremely high by 1990 standards. The bare-minimum memory requirement is 4MB (compare that with *Excel for OS/2*'s 2.5MB memory requirement), and, if you're going to use the DOS compatibility box (who isn't?), you'd better figure on at least 5MB.

You'll want a speedy hard disk and at least a 386SX, because *1-2-3/G* comes up slow on PC Labs performance tests (on most measures, it proved to be about half as fast as *1-2-3*, Release 3, running under DOS) and relies a lot on disk-based dynamic-link libraries.

But say for argument's sake that recalc time isn't crucial (the program does background recalc, anyway), that moving to the OS/2 Presentation Manager is no impediment, that you have a 25-MHz 386 or better, and that a little disk-thrashing is an acceptable tradeoff for advanced spreadsheet features. On those conditions, Lotus gives you plenty to be excited about. *1-2-3/G* combines many of the best innovations of *Excel* with the three-dimensionality of Release 3, and does not sacrifice the familiar Lotus keyboard interface and macro language.

Like *Excel*, *1-2-3/G* displays multiple worksheets on screen in individually movable and sizable windows. Worksheets can be linked to one another or, via DDE (dynamic data exchange), to external data sources. Constellations of files can be saved together as desktop files (comparable to *Excel*'s workspace files). Graphs, which live in their own windows, can be generated automatically from a selection of worksheet cells and customized with the help of gallery-style dialog boxes. The range of graphing features in *1-2-3/G* is comparable to that of *Excel*.

Like *Excel for OS/2*, *1-2-3/G* offers custom numeric formats, a variety of border and shading options, up to 256 fonts on a worksheet, and a print preview command. Lotus has included its own drivers for PostScript, HP LaserJets and compatibles (including the full series of HP cartridges), and the Epson line of printers, so most users should be able to take advantage of the program's presentation features.

But unlike *Excel*, *1-2-3/G* allows you to build three-dimensional worksheets. Files automatically include 256 pages, up to five of which can be seen at once in perspective view. A group mode makes it easy to format pages in parallel. (*1-2-3/G*'s group mode is more flexible and useful than its counterpart in Release 3; it allows you to group particular worksheet pages only, instead of clumping the whole file together.) And not only can you define ranges that cross pages, you can even create named structures that operate across multiple files.

More important for the majority of the world's spreadsheet users, *1-2-3/G* offers the benefits of the graphical interface without abandoning the familiar Lotus command structure and macro language. The keystroke sequences for all *1-2-3* Release 2 and Release 3 commands continue to work in *1-2-3/G*, though many of them now take you through dialog boxes instead of submenus. Copy and Move operations can be done via the Clipboard or in the usual *Lotus* fashion—with top-level menu commands. Ranges to be acted on by commands can be selected *Lotus*-style (after the command) or SAA-style (before).

New features—and new operating system—aside, the proficient *Lotus* user faces practi-

CONTINUED ON PAGE 36

PERFORMANCE TESTS: LOTUS 1-2-3/G

Lotus 1-2-3/G doesn't win any prizes for speed when compared to both OS/2- and DOS-based spreadsheets; its times fall pretty much in the low to middle range of the file-linking spreadsheets we reviewed in the April 24, 1990, issue.

The **Mathematical Worksheet Recalculation** test measures the time a program takes to calculate a worksheet containing 1 456 mathematical functions (square root, addition, subtraction, multiplication, division, and @SUM).

The **Loan Recalculation** test calculates the monthly payment and displays the amortization schedule for a 30-year mortgage with a given loan principal All columns except the payment and month number require recalculation

The **Internal Rate of Return** test calculates the Net Present Value (NPV) and Internal Rate of Return (IRR) for 253 different ten-year cash flows. During the test, NPV figures remain constant, but we forced the IRR function into recalculation by changing the iteration guess factor. Programs that use intelligent algorithms will recognize this distinction, while those that don't must recalculate the NPV figures, slowing their times

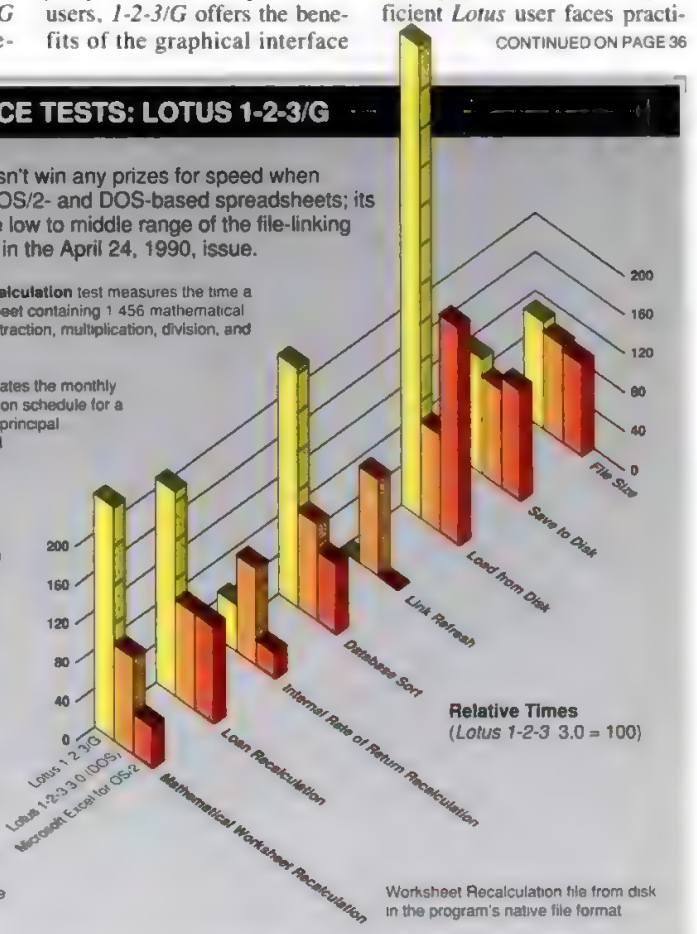
The **Database Sort** test times the sorting of a 995-record database containing text and values. The sort uses both primary and secondary keys from the ten possible fields, and no recalculations are required.

The **Link Refresh** test evaluates the sophistication of the program's linking search algorithm. Five columns by 200 rows of an external reference worksheet were linked to the corresponding cells in a link worksheet, and we measured how long the package took to refresh the links completely. The reference worksheet was kept on-disk when possible; otherwise it was held in memory. Long times typically indicate packages that must poll the disk to find the linked values on the reference sheet even if no linked values have changed

The **Load from Disk** test measures the time it takes to load the Mathematical Worksheet Recalculation file from disk in the program's native file format

The **Save to Disk** test measures the time it takes to write the same test file to disk in the program's native file format

File Size reports the size of the Mathematical Worksheet Recalculation file written to disk in each program's native file format.



Performance Times (Times given in seconds, File Size given in kilobytes)	Mathematical Worksheet Recalculation	Loan Recalculation	Internal Rate of Return Recalculation	Database Sort	Link Refresh	Load from Disk	Save to Disk	File Size
Lotus 1-2-3/G	54.70	1.90	7.80	13.50	1.30	18.00	3.40	89.00
Lotus 1-2-3 3.0 (DOS)	22 70	0.90	16.20	5.50	233 40	3 70	2 90	81 00
Microsoft Excel for OS/2	9.80	0.90	4.40	4.00	1.70	8.30	3.30	77.00

1-2-3/G

CONTINUED FROM PAGE 35

cally no learning hurdle in moving to *1-2-3/G*.

Lotus had to contort the SAA conventions to achieve this continuity. Some dialog boxes, for example, have two or more options with the same underlined letter (because they combine several submenus of the same menu stem); there are two redundant sets of printing commands (on a Print menu for Lotus compatibility and on the File menu for SAA compliance); and two main menu-bar commands (Copy and Move) have no drop-down menus at all.

But who cares if it's not an ideologically pure SAA interface? It works. In fact, in at least one way, it seems a distinct improvement over the formally correct SAA approach: the hotkey letters for all menu commands are still the first letters of the commands, so you don't have to look up at the menu when you're blasting out commands at the keyboard.

1-2-3/G doesn't have all of *Excel*'s more avant-garde features. It doesn't do arrays, it doesn't let you create function macros, it won't assign cell names based on both column headings and row stubs, and lacks certain valuable *Excel* functions (such as GROWTH and TREND). But *1-2-3/G* has the Solver, and—for the moment, at least—that puts *Excel* in a catch-up position.

The Solver is for almost anyone who has to make resource-allocation decisions (staffing, personnel deployment, budgeting, investing, product mix, estate planning, you name it) within potentially conflicting real-world constraints.

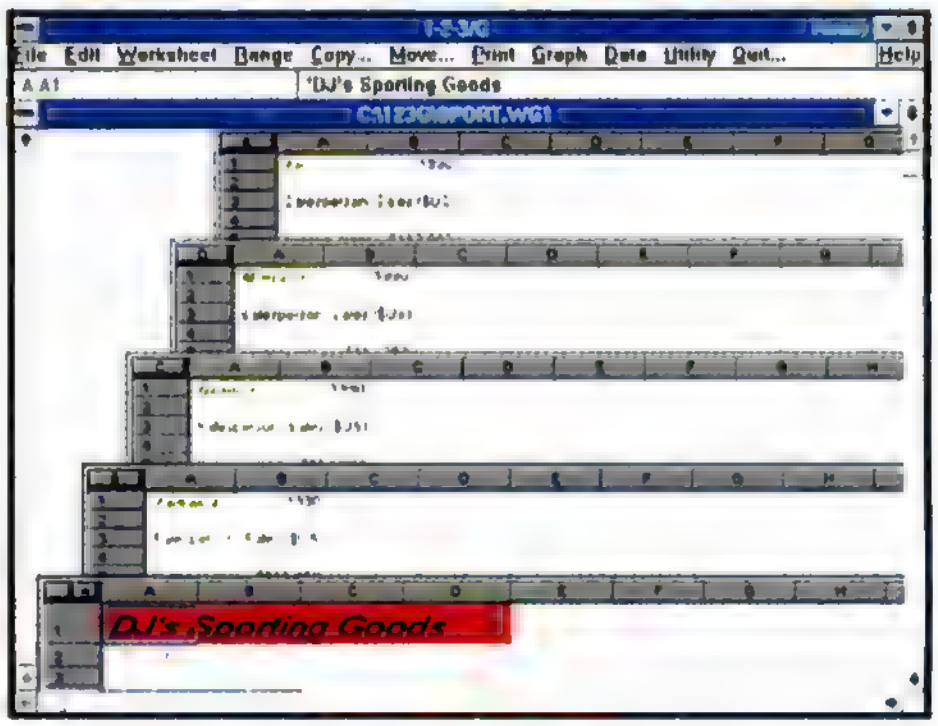
To use the Solver, you set up your problem on a normal worksheet. You tell the Solver which cell you want maximized or minimized, which cells contain values that the Solver may modify, and which cells contain the logical formulas that define your problem's constraints. Subject to memory limitations, you can define as many variables and constraints as you like. (It's hard to say where the limits lie on a 5MB system with a lot of hard disk space, but problems with a hundred or so variables and constraints appear to be well within the Solver's reach.)

If you want, the Solver will find not only the optimum solution but as many other constraint-abiding solutions as you request. If two or more constraints conflict (so that no solution is possible), the Solver will show you how each could be modified to create a solvable problem. If a constraint proves to be superfluous (that is, not binding), the Solver will show you by how much you could tighten it.

For further "what-if" analysis, the Solver will show how much you could increase or decrease the value of any variable without violating the problem's constraints. All of these reports (and this is only a partial list) can be viewed ad hoc or written automatically into separate files for printing and preservation.

The Solver is so useful and well implemented that people who have never thought of acquiring an optimization package will find themselves wondering how they ever got along without it. If the spreadsheet market were young and PC users were flocking to OS/2 (as users in 1983 were to DOS), *1-2-3/G* would probably repeat Lotus history on the merits of the Solver alone.

As matters stand, for anyone who now spends significant amounts of time doing trial-and-error allocation scenarios, the Solver is ample reason to make the big switch. But for those who use spreadsheets for more routine tasks, a move to OS/2 and *1-2-3/G* may present an insuperable resource problem all its own. And those who value speedy calculation above all else will be happier sticking with Release 2.2 or one of its faster competitors. ■



Unlike *Excel*, *1-2-3/G* lets you build three-dimensional worksheets. You can include up to 256 pages in a file, and can view as many as five of your file's worksheets simultaneously in perspective mode.

FACT FILE

1-2-3/G
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $695, single-user edition; upgrade (until 9/30/90) from *1-2-3*, Release 3 or Release 2.2, $75; upgrade from other versions of *1-2-3*, $150.
Requires: OS/2 1.1 or later; 4MB RAM. 80386-based PC, 5MB RAM (if DOS compatibility box or network software will be used) recommended.
In Short: As it did in 1983, Lotus has redefined the genre by incorporating a stunningly versatile optimization package into its GUI spreadsheet. The spreadsheet itself combines many of the best ideas of *Microsoft Excel* with the three-dimensionality of Release 3 and the familiar Lotus keyboard interface. But its hardware requirements are huge and its recalc speed only so-so.

CIRCLE 431 ON READER SERVICE CARD

Sharp

CONTINUED FROM PAGE 34

about $250.

Sharp projects the cost of the external 3.5-inch, 1.44MB floppy drive at $300. The drive includes standard connectors for an additional external floppy and for an IBM enhanced keyboard (PS/2-style connector) or compatible.

With the optional desktop external expansion module, the PC-6220 can accommodate one full-length and one half-length expansion card. Sharp projects the expansion unit at about $700. An optional, external numeric keypad will list at about $250.

Aside from the two-hour battery capacity and lack of internal floppy drive—understandable limitations for a machine of this power and size—our only real complaint with the PC-6220 concerns its balance. Though this may well change in the production units, the weight of the screen tended to make the machine feel as though it might tip backward when used on one's lap. Test one out before you buy.

With its 286 processor, VGA display, hard disk, and wealth of options, the Sharp PC-6220 is the most feature-packed notebook laptop going. It is also so light and small that you just may forget it's in your suitcase, a claim only it and the NEC UltraLite can make. Finally, with a price of $3,995, the PC-6220 matches the price of Toshiba's T1200XE and easily beats the price of a similarly equipped Compaq LTE/286. If your application demands a floppy drive or a battery life longer than 2 hours, look elsewhere. Otherwise, the Sharp PC-6220 tops all of the current notebook competition for overall power, value, and economy of size. ■

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CIRCLE 299 ON READER SERVICE CARD

Control Room Configures and Surveys Computers with Compact Custom TSR

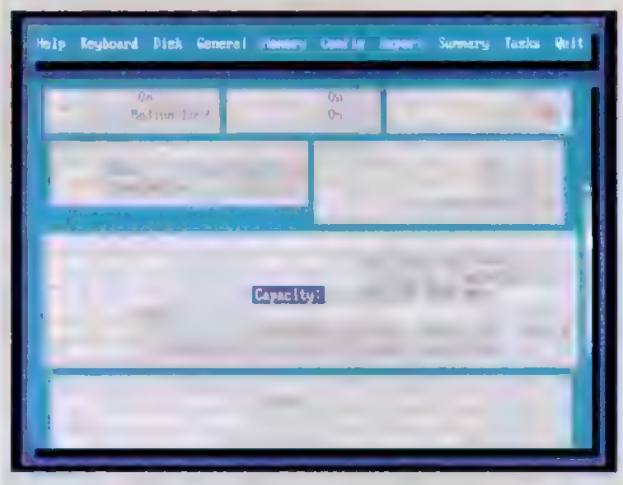
HANDS ON
by Edward Mendelson

If you use a half-dozen memory-resident utilities to configure your system with a cache, a command stack, keyboard macros, and more, *Control Room* can create a single customized utility that takes the place of all of them. And if you don't use any programs to configure your system, Ashton-Tate's $129 do-everything utility is designed to make the job effortless.

Control Room creates a customized TSR to configure your system with only the functions you choose from a series of menus. You can include keyboard functions, disk functions, and general DOS management functions, some of them normally available only in small utilities or not otherwise available at all. Because you select the features you need, *Control Room*'s custom TSR can be as small as 2.5K, but if you want to take advantage of the full range of features, the TSR will typically occupy 12K to 25K, plus as much expanded or extended memory that you assign to an optional disk cache.

You can take control of the keyboard (expanding the buffer that stores keystrokes until your application is ready to receive them) by adjusting the typematic rate, setting the initial state of the lock keys, and swapping the Ctrl and Caps Lock keys on enhanced keyboards. You can also add a keyclick (soft, medium, or painfully loud) and make the uppercase period and comma keys generate periods and commas instead of angle brackets. (When the shifted comma key prints as a comma rather than as an angle bracket, you can't access the angle brackets at all. It makes more sense to assign the angle bracket to the Alt state of the comma.)

Control Room lets you install up to five sets of different macros assigned either to shifted states of the function keys, or, in a slightly different option, to any keys you choose. The program also offers optional hotkeys that can paste the date or time into an application—or the time elapsed since you pressed a hotkey that turns on a stopwatch function.



Control Room's keyboard macros include built-in functions and multiple sets of customizable macros.

Control Room's disk cache can be installed in conventional, expanded, or extended memory, and optionally reads a full track every time it reads the disk. You can also install a disk-parking program.

Control Room's general functions include screen blanking, a command stack that lets you cycle back through previous DOS commands (but only holds 256 characters), and a daily scan for viral attacks. You can also disable Shift-PrtSc, turn off a numeric coprocessor, or redirect printer output to a file.

Other functions, available not from the TSR but from the configuration program that you run from the DOS command line, let you encrypt a file or delete it beyond recovery. A built-in editor lets you modify your CONFIG.SYS and AUTOEXEC.BAT files and enable or disable commands in both. You can run *Control Room* on a network, and the system administrator can restrict access to the program's functions with passwords.

Unfortunately, *Control Room*'s TSR refuses to load in high memory on 286- or 386-based systems. If you currently store your TSRs in high memory, you may lose more RAM by switching to *Control Room* than its all-in-one efficiency lets you gain.

But the program's powerful macros may be a more than adequate compensation. Because *Control Room* dispenses with pop-up screens and other niceties found in advanced packages like *Keyworks*, its macro functions occupy as little as 8K of RAM. Other packages need 60K or more. One ingenious option in *Control Room* lets you use the *WordStar* cursor control keys in almost any application by translating the *WordStar* "diamond" into arrow keys.

Except in its macro features, *Control Room* offers few advantages over standalone utilities beyond the efficiency of using a single, automatically installed program. You can find better DOS command-line stack programs, like *CED*, on any BBS, and you can get a better cache program in commercial packages like *Super PC-Kwik*.

Control Room's menus are almost aggressively hyperactive, with help windows sliding sideways into the screen and dizzying scrolls from one menu to the next. You can quiet it down from a special system administrator menu. My system locked up whenever I tried to exit this screen unless I ran the program from an absolutely clean DOS.

Control Room tests your system and presents a long-winded report in intelligible English on its disk, memory, and video. In my system, this report got some crucial details wrong. It said I should upgrade my DOS version from 4.0 to 4.01—even though I already use 4.01. It told me I have 5MB of free expanded memory *and* 5MB of free extended memory—even though the extended memory is already occupied by the expanded. It couldn't tell the difference between phantom drive letters created by the SUBST command and drives actually on my disk.

Most of this long system report tells you what you probably already know: that an XT is slow, that a 386 machine is fast, and that a hard disk with 300MB is very large.

Control Room's TSR, however, is a lot more compact and intelligent than its system report. For anyone who wants macros and system configuration in a single TSR, and doesn't mind loading them in low memory rather than in high, *Control Room* is the best and only choice. ■

FACT FILE

Control Room
Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90509-9972; (213) 329-8000.
List Price: $129.
Requires: 384K RAM, DOS 3.0 or later.
In Short: A unique utility that combines functions of multiple TSRs (including advanced keyboard macros) into one customized and compact TSR. It won't load into high memory on 286 or 386 systems.

CIRCLE 430 ON READER SERVICE CARD

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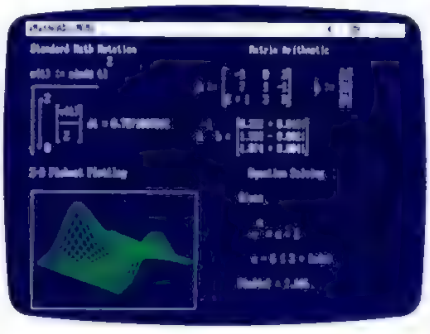

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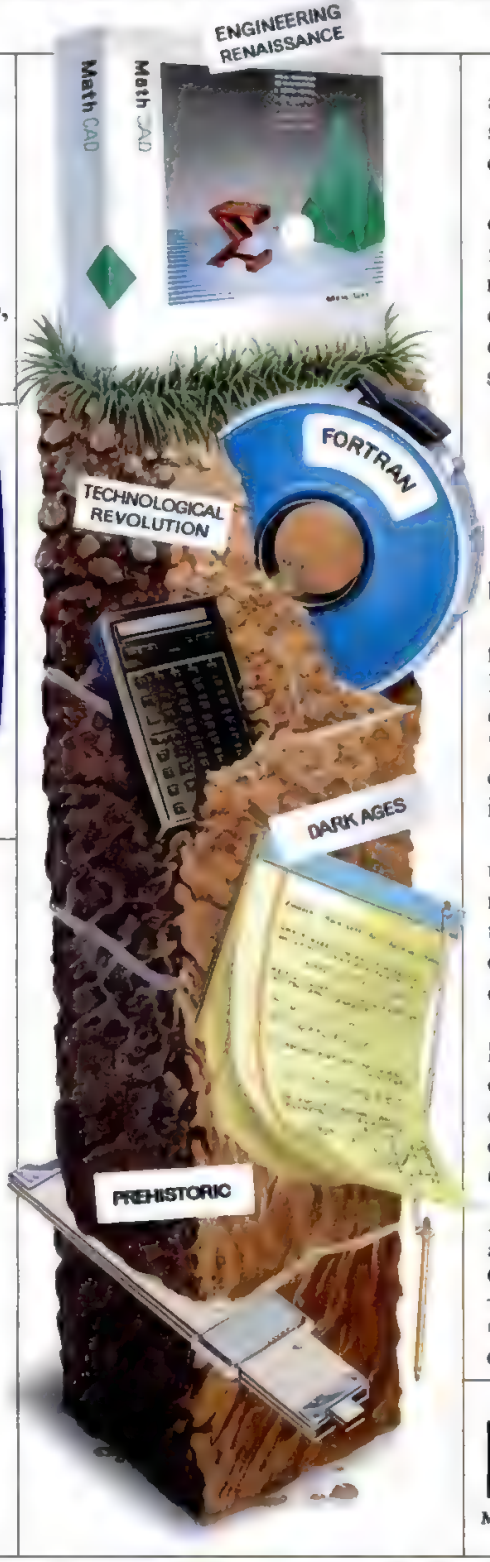

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PC MAGAZINE EDITOR'S CHOICE
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Applications Manager Offers Easy Route To Rule-based PM Programming

Even with the best programming tools, writing applications for the OS/2 Presentation Manager isn't easy. Vastly simplifying PM applications development is Intelligent Environments' *Applications Manager Professional*. The $5,000 package is probably the simplest to use of all the recently announced PM development tools, although it is not always the most sophisticated.

Applications Manager relies heavily on the rule-based programming technology found in *Crystal* (see First Looks, *PC Magazine*, January 31, 1989), Intelligent Environments' expert-system development tool for DOS and OS/2. Rules are written mostly in English and take the following format: "IF customer has account AND no invoices unpaid over 90 days, THEN grant credit approval." The IF portion, or rule expression, is an *Applications Manager* command or procedure that uses PM windows to interact with the user. Thus, creating an application becomes a process of defining rules, procedures, and interfaces until the application is complete.

While *Applications Manager* has only a handful of commands, combined with variables, arrays, tables, and over 100 functions they make for a usable programming language. The function library includes a number of general-purpose functions; routines for array and menu manipulation; string, error, and file-handling functions; and math and financial analysis support. In addition, a C interface is available, so you can add custom-written functions of your own to the system.

Applications Manager's Forms Painter lets you design interfaces as rules are written. Without writing any code, this facility lets you create windows and add menus, controls, and dialogs; then you can associate rules with any control in the interface. You can have a rule return a true value when a control is activated, or a control can cause a command or function to execute. Also, you can associate variables with controls to retain the value of an entry field or a list box selection.

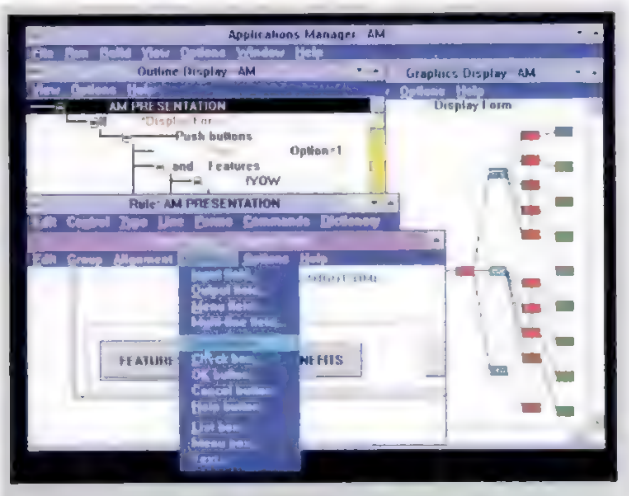
As the number of interfaces and rules increase and their relationships grow more complex, you can use the Graphic Display window to show the relationships between the procedures that make up the application. Alternatively, an Outline Display facility presents a structured outline of the application and its procedures and can dynamically expand or contract a hierarchy of rules. You can print either of these to create instant documentation. Finally, a RUN facility lets you test a new rule or interface as soon as you've created it.

Although some developers will be able to get by with the $695 *Personal* version of *Applications Manager*, the more expensive *Professional* package offers a number of additional interfaces. A file-handling interface gives you a simple way of moving data into and out of comma-delimited or fixed-length ASCII files, although there is no support for handling ordinary text or binary files. A report interface is available for writing custom reports, and another set of functions allows you to pass data between several *Applications Manager* applications. Still another interface lets you utilize the Presentation Manager's Dynamic Data Exchange (DDE) facility for transferring data to and from other PM applications. However, *Applications Manager* applications don't support multithreading, so you'll have to create an inelegant (read: kludged) polling loop to use DDE effectively.

Applications Manager also offers facilities for interfacing with SQL Server and IBM's OS/2 Extended Edition Database Manager and Communications Manager. The SQL support allows an *Applications Manager* application to pass SQL statements to SQL Server or Database Manager and features functions that create and open databases, check database status, and offer autocommit facilities. Communications Manager support offers 3270 terminal emulation, allowing you to run mainframe applications using *Applications Manager* as a front-end. With these functions, you can control up to five 3270 sessions from one *Applications Manager* application. The program also provides functions for interfacing directly with Communications Manager's low-level HLLAPI functions.

In addition to its inability to offer true multithreading to your application, *Applications Manager* has a few other notable limitations. Its support for using custom interface images is limited, and it doesn't strictly enforce CUA compliance. There is currently no way to open multiple interactive windows in an application without putting them in another application entirely (and communicating between them with DDE or global data—another kludge).

While Intelligent Environments claims that multithreaded and multiple window support will be available in an upcoming release, these deficiencies tend to limit the complexity of the applications you can develop with *Applications Manager* today. These shortcomings aside, both programmers and nonprogrammers won't find an easier program to use for prototyping and creating PM applications. ■



Applications Manager's Outline and Graphics display windows show the hierarchy of rules in the application.

FACT FILE

***Applications Manager Professional*, Version 2.2**
Intelligent Environments, 2 Highwood Dr., Tewksbury, MA 01876; (508) 640-1080.
List Price: *Professional* version (includes Reporting, Global Storage, C interface, DDE, SQL Server, Database Manager and Communications Manager support), $5,000; *Personal* version, $695; *Runtime* version, $250 per user
Requires: 6MB RAM, hard disk, OS/2, Version 1.1 or 1.2.
In Short: A simple-to-use but not entirely elegant or sophisticated application development environment for PM. While a lack of multithreaded and multiple window support hinder this release, it's a great prototyping tool and a cinch for developers to master.

CIRCLE 443 ON READER SERVICE CARD

PCED 2.0 Supercharges the DOS Command Line

HANDS ON
by Edward Mendelson

No one would complain about DOS if it came with the features that *PCED* 2.0 gives it. The Cove Software Group's $53 utility makes the DOS command line convenient, intuitive, and responsive—everything it isn't in the form provided by Microsoft and IBM.

If you ever tried to edit text using EDLIN and then switched to an advanced word processor, you have some idea of what it's like to switch from the DOS command line to the *PCED*-enhanced version of the DOS command line. With *PCED* residing in memory, you can edit at the command line easily, and you can recall and edit commands entered earlier in the same session, or even in any previous session. In addition, you can cause the same set of parameters to be appended automatically whenever you type a command.

With *PCED* you can trick DOS into ignoring internal commands like DEL and COPY and making those commands call external utility programs that handle files more safely that DOS does on its own. You can keep a timed log of computer usage, complete with the initials of individual users. You can save keystrokes with *PCED*'s command completion feature, which lets you type only the first few letters of a command, allowing *PCED* to fill in the rest. Command completion also allows you to type only the first letters of a filename that you want to use with a command-line parameter and lets *PCED* finish the job.

PCED is a rare example of almost perfect program design. Technically unsophisticated users can load the program and enjoy its benefits in a few seconds, while more experienced users can take advantage of its features to transform DOS into a fully customized environment. It is an exceptionally compact program that occupies only 17K of RAM when you use it in a system with expanded memory, or 30K in a system without EMS. If you use a memory manager like *QEMM*, *386MAX*, *QRAM*, or *Move'Em*, you can load the whole program into high memory so that it needs no DOS RAM at all.

Among the *PCED*'s advanced features is the ability to create "synonyms" that work like batch files, only better. A set of synonyms can be loaded into memory from your AUTOEXEC.BAT, and they then operate as quickly as internal DOS commands. Like batch files, synonyms can cause a series of programs to be executed in sequence, but they can also make use of *PCED*'s elaborate set of predefined variables. This means that a synonym can create a file whose name includes today's date or time or even the day of the week. A synonym, more easily than a batch file, can keep track of the current path and return to it after executing a command. You can easily set default parameters so that, for example, FORMAT will automatically format the disk in drive A: if you don't specify a drive letter. Synonyms listed in the manual let you edit your DOS path on the fly and perform other tricks that are too difficult to bother with in unenhanced DOS.

PCED comes with optional add-on programs that further enhance the DOS environment and work seamlessly with synonyms. One add-on lets you scroll back through any text that you or an application types to the screen while you work at the DOS prompt. You can pop up the recalled text while working in any character-based application if you want to refer to a directory listing, or you can capture a screen in any character-based application and refer to it while using another application. You can also send the stored text to a file.

Other *PCED* add-ons can feed keystrokes into applications, display sorted directories in up to four columns, change file attributes, and speed screen writing. Another improves on *PCED*'s handling of its stack of previous DOS commands by displaying a list at the side of the screen. Another lets you include *PCED*'s functions in DOS batch files. And one add-on lets you redefine the way your whole keyboard operates at the DOS command line so that you can, for example, make F5 bring up a directory of files in DOS just as it does in *WordPerfect*.

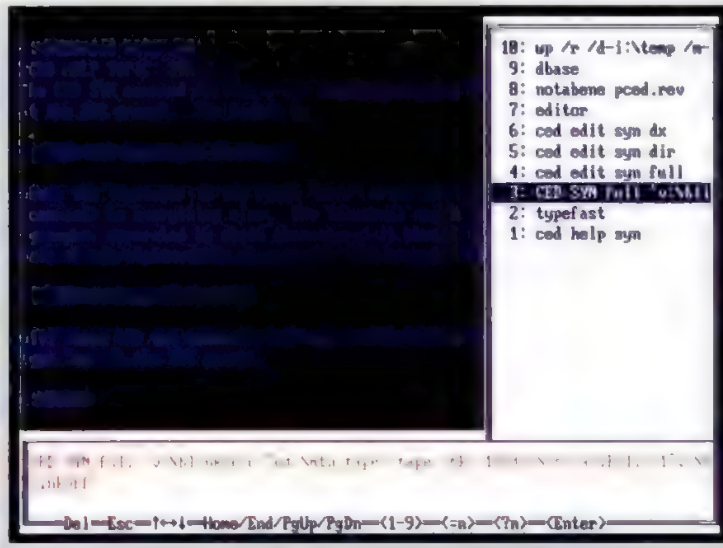
FACT FILE

PCED 2.0
The Cove Software Group, P.O. Box 1072, Columbia, MD 21044; (301) 992-9371.
List Price: $53.
Requires: 17K free RAM on systems with EMS; 23K free RAM without EMS; DOS 2.0 or later.
In Short: *PCED* gives the DOS command line the conveniences that Microsoft should have given it but didn't.

CIRCLE 441 ON READER SERVICE CARD

After two years of beta testing, *PCED* 2.0 is one of the most transparent and reliable programs on the market. It is completely customizable and never gets in the way. Although some rambunctious TSRs like *Collage Plus* keep *PCED* from operating, *PCED* itself never stops anything else.

PCED's functions are very similar to but more extensive than those found in other command-line enhancers such as *Anarkey* and *Command Manager* and resemble many of the functions in *4DOS*, which is a complete replacement for COMMAND.COM. All have their advantages, and *4DOS* adds some unique and advanced features to DOS. But none has *PCED*'s combination of convenience and power. If you can fit only one utility on your disk, make it *PCED*. ■



PCED's optional VSTACK lets you select from a list of your earlier commands that pops up when you press the Up Arrow at the DOS prompt.

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Database Publishing Software for Ventura Yields Impressive Results

HANDS ON
by Alfred Poor

Wouldn't it be great if you could get *Ventura Publisher* to work with your database without having to write a few pages of code to do so? Funny, that thought occurred to the developers at Digital Composition Systems. The vendor's *dbPublisher for Ventura* creates a powerful synergy between your data and documents, allowing you to work with the two with a minimum of fuss and a lot of flexibility.

The $249 package reads *dBASE* .DBF files directly, and will automatically extract, sort, and tag the data you want to print in a *Ventura* chapter. It can also read 16 other formats, including *R:BASE*, *Paradox*, .DIF, fixed-length and comma-delimited ASCII, and *Lotus 1-2-3*, *Microsoft Excel*, and *SuperCalc* spreadsheets. You can also import text from just about any word processor into *dbPublisher* to create mail-merge documents.

The program does not limit you to using raw data from your existing database and spreadsheet files, however. *dbPublisher for Ventura* comes with more than 90 different functions, which handle date and time calculations, financial and statistical operations, and string manipulations. Additional facilities handle arrays and create cross-tabulations.

To use *dbPublisher* effectively, you'll have to be fairly fluent with *Ventura*, since you need to know how to put multiple "paragraphs" on the same line if you want to use different fonts for separate elements in a listing. Fortunately, *dbPublisher for Ventura* comes with lots of sample style sheets that you can use as the foundation for your own projects.

After you've created a style—complete with the layout and paragraph tags for different elements—within *Ventura*, the next step is to create your report format within *dbPublisher*. The program uses its own GEM-like interface, replete with pull-down menus, but departs from *Ventura* conventions in some ways that take getting used to. For example, lines in the report format or subdirectories in a file listing can end in an ellipsis, and you must click on the periods to display the additional information they contain.

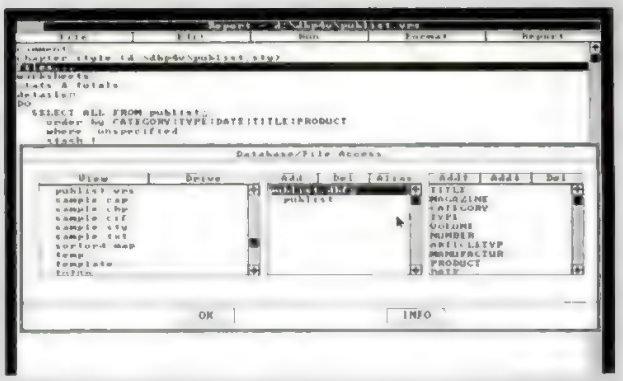
Once you get the hang of using the interface, you can quickly select database fields and couple them with the appropriate *Ventura* style tags. You can apply selection criteria to limit which data records are included in the output. You can define multiple-field sorts, group headers and trailers, and a host of other options that can result in professional-looking output.

Once the report definition is complete, you run it. *dbPublisher for Ventura* creates a text file with all your tagged information, then runs *Ventura* and automatically loads your chapter. You can then edit the document to make any final adjustments, and print it.

Although you will need to do some experimenting before you become proficient with this program, that will be time well spent. For producing high-quality printouts of database information, nothing beats *dbPublisher for Ventura* for power. ■

List Price: *dbPublisher for Ventura*, $249. **Requires:** 512K RAM; 3MB available hard disk storage; CGA, EGA, VGA, Hercules, AT&T 6300, or Toshiba 3100 display; *Ventura Publisher*, DOS 3.1 or later; Microsoft-compatible mouse. Digital Composition Systems, 1715 W. Northern Ave., #201, Phoenix, AZ 85021; (800) 527-2506, (602) 870-7667.

CIRCLE 444 ON READER SERVICE CARD



dbPublisher for Ventura can read data directly from *dBASE* and other files. Once you identify the file, the program is able to list the available fields and you can select the ones you want to include in your report.

PC-Tags: Retrieval System Provides Fast Access to Source Code Files

HANDS ON
by Barry Simon

If you've ever worked on a moderately large programming project that's been broken up into smaller modules, there have probably been times when you can't remember what a function call does or what source file it belongs to.

Moderne Software's *PC-Tags for DOS*, a $39.95 shareware source code retrieval system for programmers, will help you compensate for a faulty memory. Once you've moved the cursor to the appropriate function name in one source code file, hitting a hotkey will cause *PC-Tags* to load the proper source file for that function and move the cursor to its code.

PC-Tags's tagfile generator creates a tagfile in which information about the location of functions is kept; many methods are available for calling up the function source with a hotkey. The tagfile generator understands C, Pascal, BASIC, Modula-2, *dBASE*, and Assembler, and has built-in intelligence. For example, with the Turbo Pascal code I tested it on, the tagfile generator skiped the function declarations in the interface section of units and only cataloged the instance in the implementation section. It understood some constructs other than functions, among them structs and typedefs in C.

For retrieving source files, the program provides macros for such macro editors as *Brief*, *Epsilon*, *Kedit*, *ME*, and *Multi-Edit*. These macros are well documented, so you can modify them, and they can be configured to run a version control program. They are also quite sophisticated, ranging in size from 35K to 60K. *PC-Tags* also offers a TSR module for use with other editors, and command-line invocation capabilities for use with DOS.

A very well-implemented program that most programmers will want in their toolkits, *PC-Tags* will help you stay focused on the programming task at hand. ■

List Price: *PC-Tags for DOS*, Version 1.0, $39.95 (plus $4 for shipping and handling); *PC-Tags for OS/2*, Version 1.0, $39.95; $69.95 (plus $4 for shipping and handling) for the nonshareware joint DOS-OS/2 family application. *PC-Tags for DOS* can be downloaded for a trial period from Section 8 of PC MagNet's UTILFORUM. **Requires:** 128K RAM, DOS 2.0 or later, supported programming language. Supported editor recommended. Moderne Software, P.O. Box 3638, Santa Clara, CA 95055; (408) 247-0509.

CIRCLE 446 ON READER SERVICE CARD

Ted Standish has a bear of a job.

As Director of Information Resources for the North Atlantic Shaving Group of The Gillette Company, he has the task of simplifying and standardizing the business systems of the Company's European and North American divisions.

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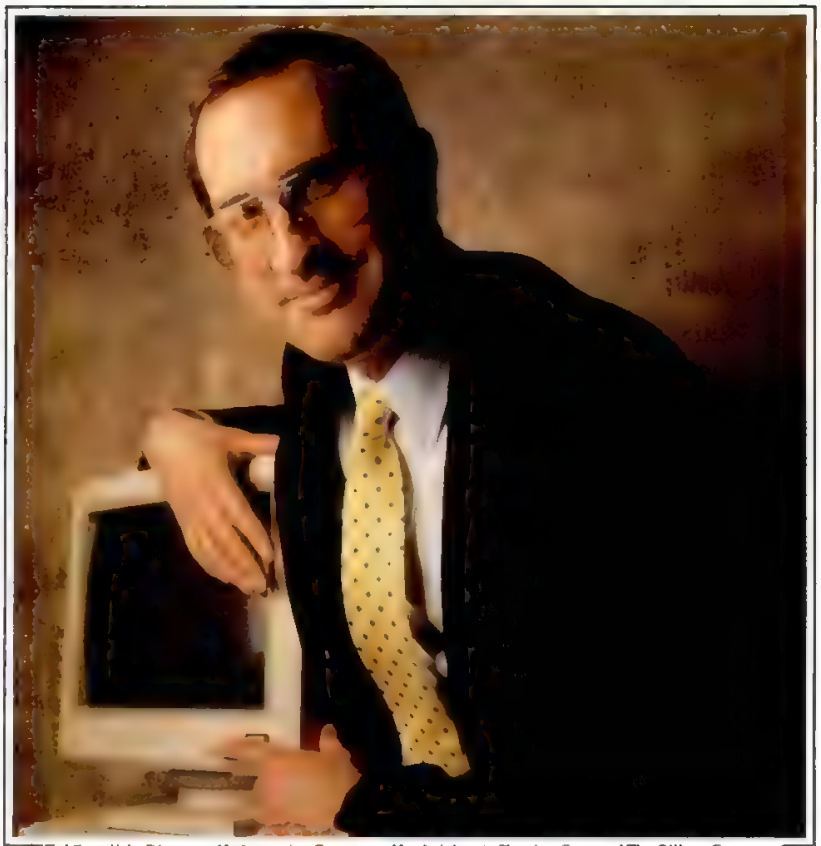

Ted Standish, Director of Information Resources, North Atlantic Shaving Group of The Gillette Company.

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Stowaway 2400: Pocket Modem for Laptops Draws Power from the Telephone Line

HANDS ON
by Alfred Poor

Internal modems for laptops offer convenience but are expensive and can drain your portable's battery in no time. Standard external modems will do the trick, of course, but require AC power and are bulky to carry. Vocal Technologies' $295 Stowaway 2400 pocket-sized modem solves the battery-life problems associated with internal and with pocket-sized modems by drawing its power directly from the telephone line. Best of all, its 2.8-ounce weight and small size won't be constant reminders that you've taken the Stowaway 2400 along for the ride.

The Stowaway 2400 pocket-sized modem is Hayes Command Set compatible. It supports auto-answering, automatic fallback to slower speeds, and nonvolatile configuration memory.

At .8 by 2.2 by 3.0 (HWD) inches, the Stowaway 2400 is just slightly larger than a typical null modem connector or gender changer. The Hayes Command Set-compatible modem works just like a full-sized 2,400-bit-per-second modem, including support for auto answering, automatic fallback to slower speeds, and nonvolatile configuration memory. In our informal tests, we encountered no problems running a number of popular communications programs, including *Procomm*, with the device.

Although the Stowaway 2400 could well be the most convenient modem to use with laptops, it could stand a few improvements. Since the Stowaway 2400 is targeted for laptops, it would make more sense for Vocal Technologies to use a 9-pin serial connector on the device rather than a 25-pin serial connector (the other side of the Stowaway 2400 has a standard RJ-11C jack); the existing configuration requires you to carry a 9- to 25-pin adapter, which will be at least as big and weighty as the modem. Also, it would be helpful if the Vocal Technologies' engineers could discover a way to add a low-power speaker to the device so that you could monitor your call's progress.

The Stowaway 2400's under-$300 list price makes it a reasonable value, especially compared with some of the more-expensive custom internal modems offered by laptop vendors. If you need to dial up while you're on the road, the Stowaway 2400 may be the modem for you. ■

List Price: Stowaway 2400, $295 (1,200-bps model, $195).
Requires: Any supported laptop. Vocal Technologies Inc., 3032 Scott Blvd., Santa Clara, CA 95054; (203) 356-1837.

CIRCLE 445 ON READER SERVICE CARD

CatchWord: Inexpensive OCR Solution for Users of Logitech Scanners

HANDS ON
by Lori Grunin

Based on Inovatic's recognition algorithm, Logitech's $199 *CatchWord* can turn any Logitech hand scanner into an inexpensive—albeit not terribly accurate—OCR system. In addition to straight vertical strip scanning, the program can rotate and recognize horizontal scans and recognize and merge two vertical halves of an 8.5- by 11-inch page.

After scanning in a text image (which is saved in an internal file that cannot be recalled by the user), the program runs the "prerecognition" module, in which it breaks the image into "models"—the bitmap patterns that the program tries to match to perform recognition. Next, the software jumps into the recognition module, which gives you the opportunity to input the correct characters based on the model displayed on screen. (You can bypass the interactive steps.) The final module allows you to correct any incorrect models; for instance, if *CatchWord* consistently thought an "s" were a "5," you'd rectify that error here.

CatchWord's basic text editor can perform search and replace and block operations. Once you've saved the text file, the program can convert it to various generations of some popular word processor formats, as well as comma-delimited ASCII. Word processor conversion basically consists of attaching proper header information to a file. *CatchWord* preserves indents as well.

Although it performs equally well on common serif and sans serif fonts, *CatchWord*'s error rate is relatively high. Out of a representative 138-word text sample, 23 models went unrecognized and 4 were misrecognized. Most of the recognition problems were ligatures such as "ff." I also found recognition for most type sizes to be a bit better at 400 dots per inch than at 300 dpi.

CatchWord's interface is simple to use—people with knowledge of OCR can probably get started without the manual—but has some inconveniences. For instance, in the revise models screen, you see only four lines of text, making it difficult to tell the difference between an occasional recognition error and an incorrect model.

Using the hand scanner remains the weakest link in the process. For instance, impatient hands can send you back to the drawing board time and time again. And you usually have to fiddle with the contrast for each passage you scan.

The software's high error rate may be unacceptable if you plan to use it to recognize large text passages. But if you're an occasional user and work with brief selections and already own one of Logitech's hand scanners, *CatchWord* provides an inexpensive OCR solution. ■

List Price: *CatchWord*, $199.
Requires: Logitech ScanMan, 450K free RAM (500K recommended), hard disk drive, DOS 3.0 or later, graphics adapter. Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; (800) 231-7717, (415) 795-8500.

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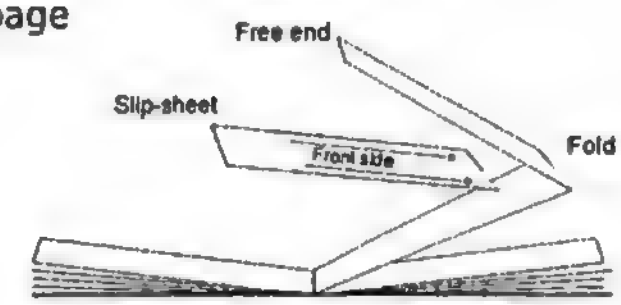
GbsSlipSheet-001

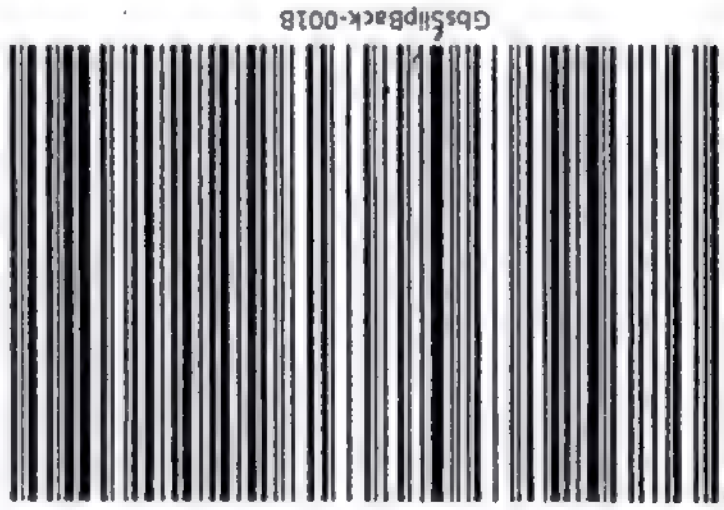
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

YES, COMPLETE. $1395

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Nothing can touch it. The ZEOS 386SX gives you Guaranteed Value you simply can't get anywhere else. And ZEOS is America's premier '386 systems manufacturer. After all, *PC Magazine* selected ZEOS '386 systems *"For Overall Excellence"* above all others. But why do they call the ZEOS 386SX "a terrific choice"? Four key reasons:

Performance. Quality.

ZEOS® 386SX

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And if you're a VGA buyer you'll absolutely *love* our VGA display. As *PC Magazine* said "the ZEOS VGA display and card prove to be one of the fastest overall...tying with the Compaq Deskpro 386S." Now that's *hot* video!

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ZEOS IS THE LEADER

10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are bench mark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent." *Personal Computing* said, "ZEOS...is the best value we've come across...its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we're open around the clock. For *your* convenience. If you buy a product from us we feel we should be there to help, 24 Hours a day. Our Help Lines are Toll Free too. Because you shouldn't have to pay for the call.

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

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ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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ZEOS INTERNATIONAL LTD

PagePak Creates Sensible And Silly Formats for WordPerfect, PageMaker, And Ventura

HANDS ON
by Edward Mendelson

There are many ways in which computers help you waste time, and the task of designing a page layout with graphic elements is one of the most effective. A job that once took ten minutes with pen and ink can now be stretched into a week or more with a graphics application or advanced word processor.

But if you prefer to get work done instead of fiddling with layouts, consider investing in one of Marketing Graphics' $145 *PagePak* packages. Each contains 50 page layouts with borders and graphic images that you can import into *WordPerfect* 5.0 or 5.1, *PageMaker*, or *Ventura Publisher*. You can then complete the layout by adding text or other images.

I tried *PagePak, Business Volume 1*, the only package released so far. The designs range from an image of a city skyline at the foot of an otherwise blank page, through a three-column page with ornamented borders, on to pages headed with a flag emblazoned "Bulletin" or a slice of a dollar bill labeled "Financial News." You also can put text on the back of a picture of a truck, and you get designs for ornamented mailing labels, menus, classified ads, and monthly calendars for 1990. Each design is shipped both as a complete *WordPerfect* document and as a .CGM or .PCX image for import into *PageMaker* or *Ventura*.

To import a design into *WordPerfect*, you run a supplied macro that displays a menu and imports the design you choose. On-screen comments tell you where you can type text or import graphics, but it's up to you to format the text correctly and choose the right text fonts from those available in your printer. A second *WordPerfect* macro helps you import clip art anywhere into a *PagePak* design or any *WordPerfect* file. You get a sampler of 36 clip-art images from Marketing Graphics' *PicturePak* series.

Diagrams in the manual give dimensions for the page designs, but when you import further graphics into the *WordPerfect* versions, you'll have to do some mental arithmetic (including converting fractions into decimals), and then find your way around some *WordPerfect* menus before you get the position right. However, with *PageMaker* or *Ventura*, if you already know how to import and resize graphics, you can manage *PagePak* designs with one hand tied behind your back.

PagePak's designs aren't very sophisticated, but they're handsome enough for many business uses. Because most designs use vector images, they'll print to the limit of your printer's ability. ■

First this *PagePak* laptop design was imported into *WordPerfect*, then the time-zone map was imported from the clip-art sampler in the package.

List Price: *PagePak, Business Volume 1*, $145.
Requires: Any system that supports *WordPerfect* 5.0 or 5.1, *PageMaker*, or *Ventura Publisher*. Marketing Graphics Inc. (MGI), 4401 Dominion Blvd., #210, Glen Allen, VA 23060; (804) 747-6991.

CIRCLE 432 ON READER SERVICE CARD

Vi-Spy Finds and Destroys Known Viruses

HANDS ON
by Neil Rubenking

There's no guarantee that your system won't fall victim to a virus. But *Vi-Spy*, from RG Software, can keep your PC from becoming an easy mark. The $250 program checks your system for known viruses and utterly wipes them out.

Vi-Spy scans both disks and RAM for virus signatures—unique strings of bytes that identify particular viruses. The program doesn't afford you the full-time protection of a TSR that is always on the lookout for virus activity, but neither does it use up precious RAM.

Regular checkups with an up-to-date version of a scanner like *Vi-Spy* can head off most virus infestations. RG Software issues quarterly updates of *Vi-Spy* to offer protection against newly discovered viruses. The first year's updates are free. After that, you can receive updates via subscription from RG Software.

Vi-Spy scans all floppy disks, hard disks, and file servers for known viruses. After checking itself, it scans executable files, boot sectors, and partition tables. Upon finding an infected program, *Vi-Spy* gives you the option of thoroughly wiping out the file. If it finds an infected boot sector on a floppy disk, it then will wipe out and rebuild it.

Vi-Spy wipes out infected files by overwriting and then erasing them. It's actually possible to restore disk data that has been overwritten; with enough computing power you can theoretically restore up to seven "layers" of data. *Vi-Spy*'s technique of overwriting an infected program seven times meets government standards for secure file erasure.

Vi-Spy's manual could serve as a textbook on fighting viruses. It describes how they operate, how to avoid infection, and what to do if you suspect a virus. The text is level-headed and refreshingly free of virus hype. In fact, the author doesn't hesitate to point out that "there are thousands of possible causes for a problem other than a virus." Among the tips: download software only from reputable BBSs (bulletin board systems), don't use pirated software, and back up your data often.

The number of viruses is increasing steadily, but you're still more likely to suffer a hard disk crash than a virus attack. *Vi-Spy* will help protect against viruses, and regular backups will let you recover from either disaster. ■

List Price: *Vi-Spy*, Version 2.0, $250. **Requires:** 128K RAM, one 5.25- or 3.5-inch floppy disk drive, DOS 2.0 or later. RG Software Systems Inc., 2300 Computer Ave., #A-7, Willow Grove, PA 19090; (215) 659-5300.

CIRCLE 447 ON READER SERVICE CARD

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- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (2-8 BIT, 6-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
- SUPPORTS 80287 CO-PROCESSOR AT 10MHz OR 12MHz
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- 16⅛" W x 6" H x 16¾" D
- ***SPECIAL FEATURE:** THIS SYSTEM CAN BE UPGRADED TO A 386/SX USING CPU MODULE*

PC MAGAZINE *"Don't pass over the CPU 286 12MHz" —Sept 1989*

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- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (2-8 BIT, 6-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
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- LIM EMS V.4 DRIVER INCLUDED
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- 200W POWER SUPPLY
- SYSTEM BOARD MADE IN U.S.A.
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- KEYBOARD SELECTABLE CPU SPEED
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PC MAGAZINE *"It seems able to do what other SX machines do, only better and faster"—August 1989*

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71MB MFM/28MS	730	870	1,105	1,215
100MB IDE/25MS	760	900	1,135	1,245
150MB ESDI/18MS	1,095	1,235	1,470	1,580

*Prices listed are available with complete system purchase only.

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- 1.2MB OR 1.44MB FLOPPY DRIVE
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- 8 EXPANSION SLOTS
- KEYBOARD SELECTABLE CPU SPEED
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- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS
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- SUPPORTS INTEL 80387 & WEITEK 3167 CO-PROCESSORS
- 5 5¼" HALF-HEIGHT DRIVE BAYS
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- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
- SUPPORTS INTEL 80387 & WEITEK 3167 CO-PROCESSORS
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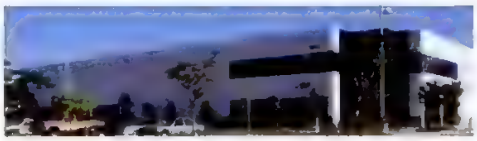

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by
Matthew J. Ross

New&Improved

News of Announced Products and Upgrades

Wang Image Editor For Windows Supports DDE

NEW

Image Wizard, a black-and-white image editing package from **Wang Laboratories** accepts scanned images up to a resolution of 300 dots per inch (dpi), as well as TIFF, .PCX, Wang Image File Format (WIFF), and *Microsoft Paint* .MSP formats. The $295 program, which runs under *Microsoft Windows* and supports its dynamic data exchange (DDE), also offers direct support of Wang's SC3000 and the HP ScanJet scanners within the application.

With *Image Wizard*, users can enhance images by adding text annotations, using the drawing tools, or selecting from the geometric shapes available. You can mirror, rotate, invert, outline, darken, or lighten images. Multiple files can be combined to create one image. *Image Wizard* also features a screen-capture facility for *Microsoft Windows*. In addition, it converts gray-scale images to black-and-white bits and lets users edit on a pixel-by-pixel level using the software's Obese Bits command. The package works with all *Microsoft Windows*–compatible peripherals.

List Price: *Image Wizard*, $295. **Requires:** 640K RAM, *Microsoft Windows/286* or *Windows/386*, Version 2.1 or later, DOS 3.2 or later. Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; (800) 225-0234, (508) 459-5000.

CIRCLE 440 ON READER SERVICE CARD

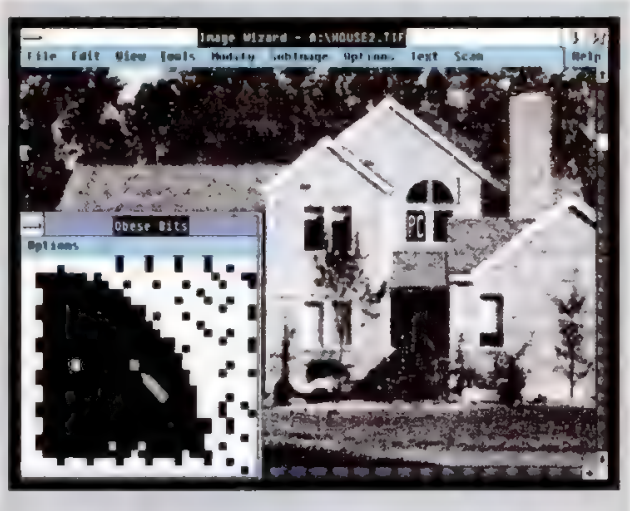
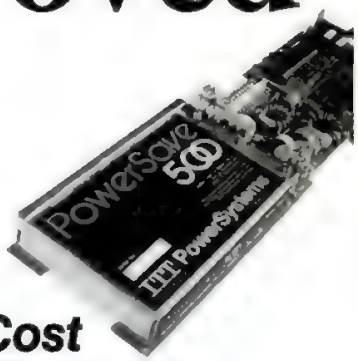


Image Wizard features an Obese Bits function for pixel-by-pixel image editing.



Low-Cost UPS Fits Inside Your PC

NEW

You can never be too thin, or too safe with your data. To safeguard against power glitches, **ITT PowerSystems** has released an internal UPS for personal computers. The VIP PowerSave 500 is a full-length 8-bit I/O card with internal power supply and shutdown software. The VIP PowerSave 500 features 12 nickel cadmium cells for up to 15 minutes of battery-backed time for your computer. Due to its thickness, the card may impinge on the adjacent expansion slot.

In the event of a power failure, the VIP PowerSave 500 automatically saves a copy of the system's current state to the hard disk, then shuts down the entire system. Once AC power resumes, the PowerSave 500 restores the computer to its previous state. According to ITT, the internal UPS monitors the PC's internal power supply to ensure clean DC power to the computer's systemboard.

List Price: VIP PowerSave 500, $329. ITT PowerSystems Corp., 3400 E. Britannia Dr., Tucson, AZ 85706; (602) 889-7600.

CIRCLE 438 ON READER SERVICE CARD

RACET Offers 35-ms 600MB Erasable Optical Drive

NEW

RACET Computes Ltd. has introduced a 600MB optical erasable Winchester drive aimed at the graphics, desktop publishing, CAD, network, and large database markets. The Cosmos 600 is an external storage device that provides 295MB of formatted capacity per side in a removable compact disk storage cartridge. It features a disk-read throughput speed of 450K per second, with disk write speeds of 150K per second, according to the

CONTINUES ON PAGE 54

HOT PROSPECT

Q/COR SHIPS 20MB FLOPPY DISK DRIVE SUBSYSTEM

Taking advantage of disk developments by Brier Technology, **Q/COR** has introduced a 20MB removable floppy disk and disk drive subsystem. Stor/Mor 3.5-inch drive units are available for both industry standard architecture (ISA) and Micro Channel PCs. Featuring Twin Tier tracking technology, Stor/Mor places data tracks significantly closer together by recording a magnetic signal that indicates where data is recorded. Stor/Mor provides random access and a data capacity of 21.4MB on Brier's reformatted Flextra disks. Average access time is 35 milliseconds, putting performance on par with many hard disk drives, according to the manufacturer. The Stor/Mor subsystem includes utility software, a DOS device driver, and an on-board BIOS that allows the drive to be a boot device.

List Price: Stor/Mor, $895 for external AT-interface subsystem, $795 for internal disk subsystem, $995 for internal MCA subsystem, Flextra 25MB 3.5-inch floppy disk, $25. Q/COR, One Meca Way, Norcross, GA 30093; (800) 548-3420, (404) 923-6666.

CIRCLE 433 ON READER SERVICE CARD

RACET

CONTINUED FROM PAGE 53

company. RACET is also offering a three-year parts-and-labor warranty on the optical drive.

The Cosmos 600 includes *PCMS EZ* installation software, which RACET says permits installation in 10 minutes. *PCMS EZ* lets users choose from nine popular DOS and Novell partitioning schemes in a menu-driven interface. In addition to being included in the Cosmos 600 package along with the optical erasable drive and adapter card, *PCMS EZ* will be bundled with RACET's current line of Winchester drives, the pcMAXimum Storage Series of optical and mechanical SCSI drives, and the pcMACsimum Storage Series for the Macintosh.

List Price: pcMAXimum Cosmos 600 optical storage unit with *PCMS EZ* software, $5,195; CD storage cartridge, $295. RACET Computes Ltd., 3150 E. Birch St., Brea, CA 92621; (714) 579-1725.

CIRCLE 435 ON READER SERVICE CARD

***Collage PM* was used to capture itself for this OS/2 screen grab.**

EtherVision Monitors Traffic on Ethernet LANs

NEW

Triticom has released a real-time traffic monitoring tool designed to work with Ethernet LANs using any Novell NE2000 or compatible Ethernet adapter. *EtherVision* monitors Ethernet traffic activity and errors, including fragmented packets caused by collisions.

With *EtherVision* users can track network use and determine the effectiveness of the server in transferring information. Users may

CONTINUES ON PAGE 59

EMS Offers Shareware Utilities Library For Novell NetWare LANs

NEW

EMS Professional Shareware Libraries has gathered over 170 public domain and shareware utilities from electronic bulletin board systems throughout the United States in order to aid administrators of Novell *NetWare* local area networks (LANs). The *NW Utility Library* includes various drivers for network interface cards, bug fixes for certain *NetWare* programs, menu systems for administrating Novell networks, diagnostic and debugging programs, e-mail programs and support routines, archiving and server file recovery utilities, network disk repair programs, and how-to and help files.

The utilities are compressed onto 17 disks with the PKZIP compression program. EMS provides an index featuring a description of all the utilities and a database search engine that supports free-text searches across all product descriptions, as well as searches by utility name, filename, vendor, or type. EMS also offers shareware utility libraries for *dBASE*, *AutoCAD*, *Lotus 1-2-3*, *WordPerfect*, and programs written in Turbo Pascal, assembly language, and C.

List Price: *NW Utility Library*, $49.50.

Requires: DOS 2.1 or later. EMS Professional Shareware Libraries, 4505 Buckhurst Ct., Olney, MD 20832; (301) 924-3594.

CIRCLE 434 ON READER SERVICE CARD

IMPROVED

Collage PM—Inner Media has ported its screen capture and image handling software over to the OS/2 operating system. *Collage PM* allows users to capture bitmapped or raster images from the OS/2 Presentation Manager environment into .PCX, TIFF, Metafile, and System Clipboard file formats. *Collage PM* converts files between these formats, permitting users to use images from different clip-art libraries and software packages. Images can be manipulated with image-handling tools such as zoom, crop, reverse, dither, and preview. *Collage PM* retails for $199. Inner Media Inc., Hollis, N.H.; (603) 465-3216.

***WealthBuilder by Money Magazine*, Version 1.1**—Targeted at the personal investor, Reality Technologies' *WealthBuilder by Money Magazine* has been updated to include 4,000 stocks and 6,000 bonds from Standard & Poor's mutual funds database. Other enhancements to help you make your fortune include new product strategies to aid investment selection; a portfolio manager to assist in entering new assets, maintenance and price updates of portfolios, and easy liquidation of sold assets; and timeline analysis to develop long-term financial strategies. According to Reality Technologies, import and export from *Quicken* and *Managing Your Money* have been enhanced, and the program's file management has been improved. The program has also been streamlined to take up 40 percent less disk space. *WealthBuilder by Money Magazine* retails for $249.95. Reality Technologies, Philadelphia, Pa.; (800) 346-2024, (215) 387-6055.

***Right Hand Man*, Version 5.0**—Futuresoft's TSR workgroup software now uses only 4K of memory on NetBIOS networks and 5.9K on a Novell IPX network. A text-to-speech function allows a digitized voice to alert users that they have e-mail, in addition to traditional on-screen notification. Other improvements include a database module with *dBASE* import and export, a laptop-to-LAN file merge feature, and a proprietary memory management system that does not need extended memory. *Right Hand Man* retails for $189 for a single user. Multiuser prices start at $495 for a five-user system. Futuresoft Inc., Metairie, La.; (800) 327-8296, (504) 837-1554.

***Total Word*, Version 1.3**—Volkswriter's new version of its word processing software features improved editing and printing capabilities as well as reduced program and printer driver loading times, according to the company. Editing

CONTINUES ON PAGE 56

Logitech's foolproof desktop tools let anyone turn out smart looking documents. And now with Logitech's special prices, there's never been a smarter time to buy them.

ScanMan® Plus. *Scans images up to 4" wide into any document instantly. Works with all major applications. Adjusts to 400 d.p.i., 32 shades of gray, with three photo settings. Suggested Retail Price (SRP): $339.*

CatchWord™ Intelligent O.C.R. *Lets you use text scanned with ScanMan in applications, just as if you'd typed it in. CatchWord accurately recognizes type from 6-20 points in virtually any typeface at speeds of up to 2,000 characters a minute. SRP: $249.*

Finesse™ Desktop Publishing *lets you design brilliant documents effortlessly with direct scanner support, pre-designed page formats and automatic text wraparound. The only inexpensive DTP software to include Bitstream® Fontware™ absolutely free (a $545 value). SRP: $179.*

Logitech™ Series 9 Mouse. *Awarded rave reviews for its comfortable shape, adjustable resolution and ballistic drivers for flick-of-the-wrist control. Includes Pop-Up DOS™ and mouse menus to mousify almost any application. SRP: Serial-$119, Bus-$139, PS/2-$119, Serial & PS/2-$149.*

TrackMan.™ *Ingenious thumb-operated stationary mouse offers comfort and precision without desktop motion. Guaranteed compatible with all PC applications supporting Logitech or Microsoft® mice. SRP: Serial-$139, Bus-$149.*

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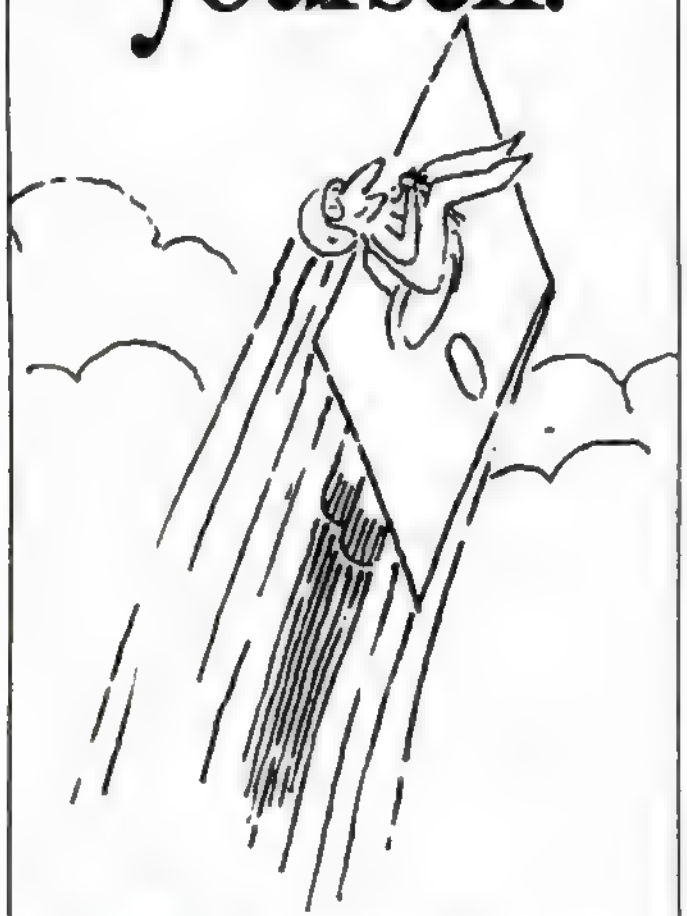

PC-Kwik Power Pak for total system speedup.

"Super PC-Kwik is the fastest cache program available.... When you combine it with the RAMdisk, print spooler, and other programs in Multisoft's PC-Kwik Power Pak, Super PC-Kwik makes better use of your memory than any other cache you can buy."

PC Magazine 2/14/89

"Not only is Super PC-Kwik the fastest utility we tested, but its compatibility, installation, tuning options, and documentation are also tops, making this Best Buy well worth the price."

PC World 2/90

"This collection of utilities has boosted my system's performance more than I ever dreamed possible...Soon after Power Pak's installation the wonders began...The acceleration this produces must be experienced to be believed."

Tom Swan, "Developer's Toolbox," PC World 9/89

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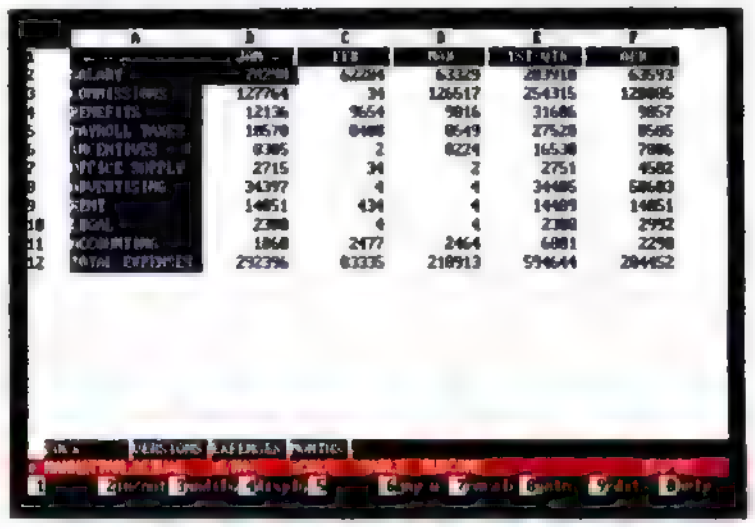
IMPROVED

CONTINUED FROM PAGE 54

improvements include simplified text block marking, clipboard cut and paste, and additional document management information with each file. *Total Word* supports expanded memory and is installable on any DOS 3.1 network that supports redirection and file locking, such as IBM PC Net, Token Ring, Novell, 3Com, and Banyan. Improved printer support include scalable fonts for the HP LaserJet III and PostScript printers. *Total Word* is available for $495. Upgrades from any previous version cost $69. Volkswriter Inc., Monterey, Calif.; (408) 373-4718.

***TM/1*, Version 4.0**—Sinper Corp.'s latest version of its relational spreadsheet now supports worksheets as large as 512 columns by 32,000 rows, and the maximum size of a *TM/1* table has been expanded from 32 to 128 MB. A new Delete command clears worksheets and releases memory without erasing the relational table. Other new features include improved graphics, pie and area charts, the ability to upload tables in comma-delimited ASCII to mainframes, a looping function to perform calculations on every value in a table with one formula, interruption of spreadsheet recalculation at any time, and the ability to shell out to DOS temporarily. *TM/1* retails for $795, with an upgrade available for $140. Sinper Corp., Warren, N.J.; (800) 822-1596.



Data for *TM/1* worksheets are stored in relational tables, not in the actual worksheet.

***Type Director*, Version 2.0**—Agfa Compugraphic's upgrade of its *Type Director* typeface scaling and font management utility for HP LaserJets creates downloadable PCL soft fonts by converting typeface outlines into bitmaps that can be scaled from 4 points to 200 points in quarter-point increments. *Type Director* has also added support for the Microsoft Publishing Symbol Set. Additional hardware support includes the HP LaserJet IIP, DeskJet and DeskJet Plus, and the PaintJet XL. *Type Director* also directly supports the LaserJet III's internal typeface-scaling capabilities. Agfa has also introduced 64 new Intellifont scalable typeface outlines to be used in conjunction with *Type Director*. Version 2.0 retails for $99 with a $40 upgrade available for registered users. Agfa Compugraphic, Wilmington, Mass.; (508) 658-5600.

***386-DOS*, Version 3.02**—Concurrent Controls has improved its multiuser DOS alternative to PC networks with new security and electronic mail features. In addition to general e-mail support, Concurrent Controls has added a takeover utility for diagnostics and maintenance. Also included is a broadcast mode for chaining terminals together for group training. An optional security shell restricts system access, and a remote access system utility monitors for disconnects and inactivity. Users can individually reboot their consoles, and with CCITerm terminal emulation, users can use their PCs as workstations. *386-DOS* starts at $695 for up to eight users. Concurrent Controls Inc., South San Francisco, Calif.; (415) 873-6240.

***TAL*, Version 2.0**—Timeslips has upgraded *TAL*, its *Timeslips III* Accounting Link software so that it now functions without requiring an accounting package. Among the new features are open item invoicing, client statements, and invoice analysis reporting. Users can generate reports and statements to include fees, costs, taxes, adjustments, outstanding balances, and interest accrued, and can organize these reports by invoice number. New income analysis reporting is available, either in detail or summary format. *TAL* now posts all fees and expenses to a specific user, client, activity, or controller expense slip instead of a general ledger. The Version 2.0 upgrade of *TAL* costs $79.95. Timeslips Corp., Essex, Mass.; (508) 768-6100.

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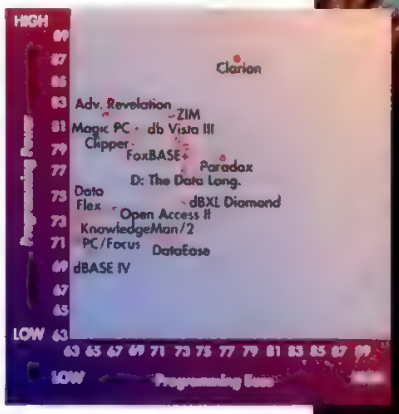

Here's what American corporations in a PC Week survey thought of the power and ease of use of Professional Developer vs. competitors. Any questions?

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New DisplayWrite 5. Get what you want, without giving up what you have.

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DisplayWrite 5 also offers advanced merge options, multi-column formatting support for a variety of fonts and more printer support than ever.

And since the new version is fully compatible with the entire DisplayWrite family, your company's current investment in software and training remains intact. The uncomplicated pulldown menus make it easy for experienced users to employ new features and for new users to learn, right from the start. If anyone has a question, a toll-free support line is there to help.

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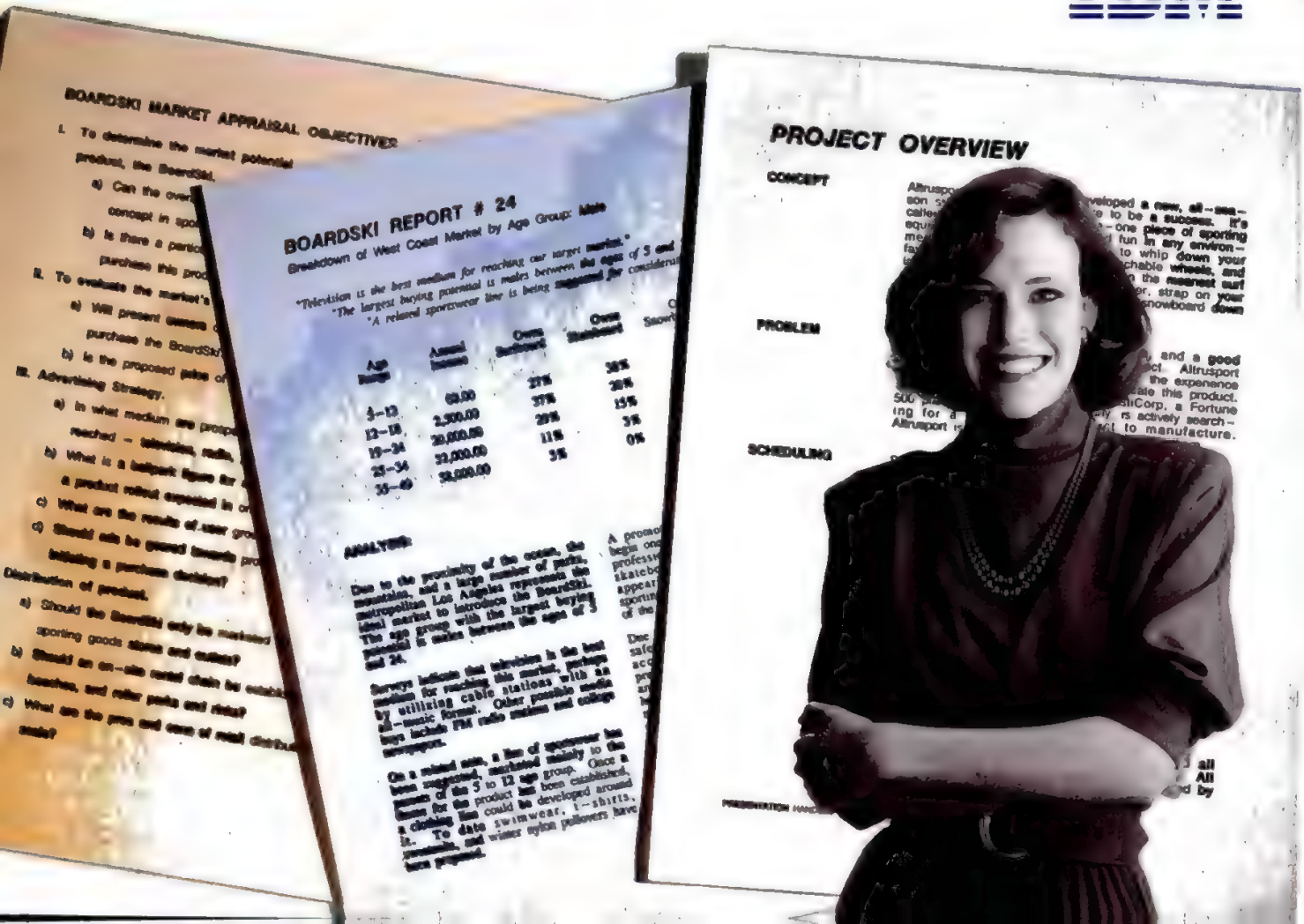

New & Improved

EtherVision

CONTINUED FROM PAGE 54

also assign user names to network addresses. *EtherVision* displays two real-time monitoring modes: the normal monitoring mode tracks packets and kilobytes sent by each station, while skyline monitoring displays network trafficking over time and total use.

List Price: *EtherVision*, $225; with Triticom-certified Ethernet adapter, $525. **Requires:** 256K RAM, DOS 3.1 or later. Triticom, P.O. Box 11536, St. Paul, MN 55111; (612) 937-0772.

CIRCLE 438 ON READER SERVICE CARD

Proxima LCD Panel Projects 512-color VGA Graphics

NEW

Computer Accessories is the first full-color VGA LCD data projection panel. According to the company, its Proxima Data Display VersaColor panel supports 512 colors in 640 by 480 pixels for graphics, or 720 by 400 pixels for text. The VersaColor combines three separate primary-color LCD panels (red, blue, and yellow) into one unit, governing contrast and voltage to each panel with an on-board microprocessor. The VersaColor measures 12.5 by 12 by 1.9 inches, weighs 6 pounds, and comes with a remote control.

List Price: Proxima Data Display VersaColor, $6,499. Computer Accessories Corp., 6610 Nancy Ridge Dr., San Diego, CA 92121; (800) 582-2580, (619) 457-5500.

CIRCLE 439 ON READER SERVICE CARD

Bootcon Offers Multiple PC Configurations

NEW

To help overcome memory conflicts of various software and device drivers, **Modular Software Systems** has designed *Bootcon*, a utility that allows users to create up to 26 different system configurations with one AUTOEXEC.BAT and one CONFIG.SYS file. *Bootcon* loads like a device driver in the CONFIG.SYS file. Upon system boot-up, users are presented with a menu selection to determine which TSRs and device drivers are loaded. *Bootcon* removes itself from memory after selection, and if no memory option is chosen, a default selection is made, thereby providing hands-off system boot-up. ■

List Price: *Bootcon*, $59.95. **Requires:** 256K RAM, DOS 3.10 or later. Modular Software Systems, 115 W. California Blvd., #113, Pasadena, CA 91105; (818) 794-7602.

CIRCLE 437 ON READER SERVICE CARD

Definitions on disk

Language Master gives you instant access to more than 80,000 dictionary definitions plus 470,000 synonyms from Merriam-Webster—the English language authority.

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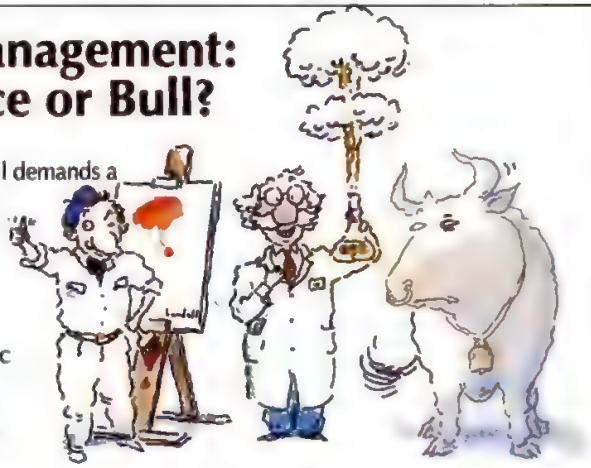
CIRCLE 224 ON READER SERVICE CARD

Project Management: Art, Science or Bull?



Running a project well demands a special blend of make-it-happen skills. No manager can bring it all together consistently by depending on intuitive artistry, rigid technique, or enthusiastic hoorays and hoopla.

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edited by
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Read Only

Reviews of the Latest Books for the PC User

Commandments And Apocrypha for Printer Users

■ *The Printer Bible*
by Scott Foerster;
Que Corp., $24.95

If the struggle to make a printer do its job has ever brought you to the edge of despair, you may sing hosannas to the 650 pages of good news in *The Printer Bible*. Que Corp.'s $24.95 guide for the printer-perplexed is the only book on the market that attempts to be a universal printer reference, complete with advice on buying, installing, and maintaining anything from a humble dot matrix to the proudest laser. If it doesn't achieve the inspiration suggested by its title, it often points out the path to salvation.

The book starts with an introduction to various printer technologies. Next comes a guide to selecting a printer—with two pages on how to use *PC Magazine*'s annual printer issue. A chapter on installation has hints and reassurances you won't find in a manual. A section on typesetting includes an evangelical chapter on the blessings of PostScript. The closing chapters comprise an immense list of solutions to printer dilemmas of all kinds, including the intricacies of cables.

The Printer Bible doesn't cover every printer on the market, but it offers enough details about standard Epson, Diablo, PostScript, and Hewlett-Packard models to let you solve tricky hardware and software problems without opening a manual.

Unfortunately, you can't place absolute faith in *The Printer Bible*. An unsettling number of details are muddled or inaccurate. The book says you can use COM3 and COM4 without mentioning that the PC BIOS and DOS before Version 3.3 won't recognize them. A section on configuring *WordPerfect* confuses the *WordPerfect* program with its separate printer-definition program. The author seems to think Bitstream fonts have limited use because they're encrypted—but they aren't. A paragraph on PostScript cartridges wrongly says you'll need another cartridge for additional fonts. The book's chronicle of the Adobe-Microsoft font wars gets crucial facts wrong—and these are only a few examples of the book's mistakes.

Everything you always wanted to know about printers; now you know where to ask.

But *The Printer Bible* is worth owning anyway for its ingenious troubleshooting tips and appendices of printer codes. Just don't treat every word in it as the gospel truth.—**Edward Mendelson**

Que Corp., 11711 N. College Ave., Carmel, IN 46032; (800) 428-5531. ISBN: 0-88022-512-2.

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Getting Data from Here to There

■ *Data Exchange: PC/MS DOS*
by Steven S. Ross; McGraw-Hill, $24.95
■ *The Data Exchange: Moving Data between 1-2-3, dBASE, and Other Popular Programs*
by Alfred Poor; Dow Jones-Irwin, $24.95

Since file formats change so frequently, writing about data conversion can be a hazardous business. Despite their 1990 copyrights, both *The Data Exchange: Moving Data between 1-2-3, dBASE, and Other Popular Programs*, and *Data Exchange: PC/MS DOS* already look dated; among the major topics missing from both volumes are *WordPerfect* 5.1, *Microsoft Word* 5.0, *MultiMate* 4.0, and *Lotus 1-2-3*, Release 3.0. Poor covers *WordStar* 5.5, while Ross only goes up to Version 4.

Both books do a good job describing database formats and telling readers how to get .DBF information into *1-2-3*. They also provide readable explanations of *1-2-3*'s pesky Parse command.

Ross's book, the more technical of the two, includes details about the formatting, line-ending, and paragraph-ending codes used by a great many word processors. It also includes BASIC and C high-bit strippers and an appendix on using DEBUG or the *Norton Utilities* to clean up binary waste matter. Unfortunately, the appendix on Lotus file structure is so superficial as to be useless.

While Ross acknowledges *Microsoft Excel*'s existence, and even briefly discusses DDE (dynamic data exchange)—although he asserts that plain old *Microsoft Word* for the PC supports DDE—Poor's only spreadsheet is *1-2-3*.

On the other hand, Poor addresses the less technical reader, stressing the use of programs' search/replace facilities for format conversion. He provides BASIC programs for converting between fixed-length and delimited formats, getting the Greek out of *WordStar*, and stripping particular ASCII characters, but stops short of providing *Microsoft Word* and *WordPerfect* macros. He also briefly reviews a couple of graphics file-conversion programs, although neither book says anything of significance about the multitude of current graphics formats.

Although Ross deals with more word processors than Poor, Poor covers the major mail-merge formats—an important omission in Ross. Poor also devotes a couple of valuable chapters to file-conversion utilities.

There's plenty of value in both books, but whether there's any for *you* is hard to say. If either volume has a paragraph or two on the problem you're trying to solve, take it home. You'll get your money's worth.—**Craig Stinson** ■

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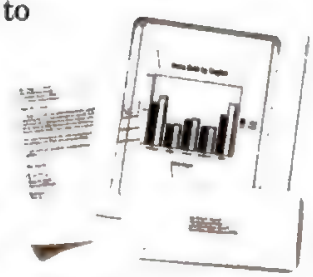

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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Lotus and Novell Unite in Bid to Control Standards

There seem to be as many opinions on the meaning of the Lotus acquisition of Novell as there are users with strong commitments to both companies' products.

By giving Lotus stock to Novell shareholders and making the Provo, Utah, network software company a division of Lotus, Jim Manzi has regained for Lotus the number one status among PC software companies that it surrendered to Microsoft in 1987, based on total revenue (see next page for *Soft-Letter*'s ranking of the top software companies).

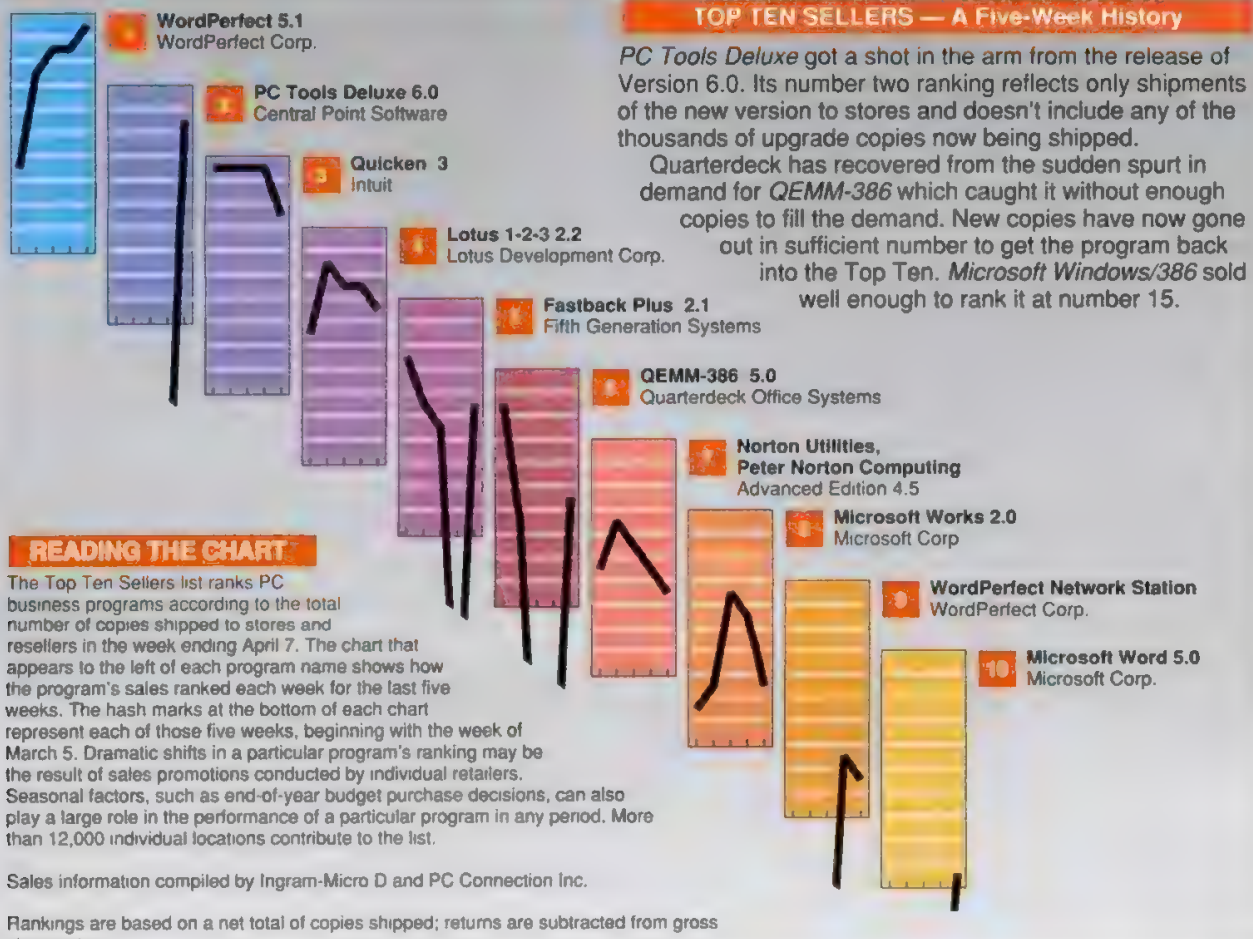
What Manzi's done, strategically, is to buy clout for Lotus in the battle to establish standards for the next generation of software.

Manzi has publicly berated Microsoft for what he saw as a failure to establish OS/2 and its successful promotion of an alternative: *Windows*. At issue is the large investment Lotus made in OS/2 and the problem Lotus faces in marketing *1-2-3/G*. After three years of work bringing the spreadsheet to a fully graphic environment, Lotus finds that *Windows* is running on the two million PCs that were supposed to be running OS/2 by now.

Fueling that frustration is Microsoft's knack for seizing the momentum in software progress. As Lotus was finishing up its work on *1-2-3/G*, the buzz among key clients was not about OS/2 but about the major enhancements Microsoft is planning to build into the next version of *Windows*.

And as *NetWare* makes steady progress in establishing itself as the leader in networking software, it has had to work hard to counter Microsoft's natural advantage: control of the DOS file system.

CONTINUES ON PAGE 64



Pipeline

CONTINUED FROM PAGE 63

On balance, though, Novell seems to have much less to gain from the merger. It was in a very comfortable position; it had successfully fended off the initial challenge from *LAN Manager*. In fact, Microsoft seems to be stepping back with the product in an attempt to relaunch it, on its own, without 3Com Corp.'s participation. There are rumors of a Microsoft brand of *LAN Manager* in the works, and that seems to be the threat that got executives at Novell thinking about alliances.

Assuming the merger is completed by July as planned, the new company is unlikely to back away from its current individual policies: remaining compatible with as many products as possible. Lotus has emphasized that its products would run on *LAN Manager*, IBM's *LAN Server*, and as many other networking environments as demand requires. As if to prove that point, it just announced shipment of DataLens drivers allowing *1-2-3* to directly access *SQL Server* database running under OS/2 *LAN Manager*.

However, Lotus did hold out the prospect of optimizing *1-2-3* for *NetWare* performance once the top teams of software engineers get together.

Top PC Software Companies in 1990

	Company	Revenues (in millions)	'89 Rank
1	Microsoft Corp.	952.8	1
2	Lotus Development Corp.	556.0	2
3	WordPefect Corp.	281.4	4
4	Ashton-Tate Corp.	265.3	3
5	Autodesk	177.0	5
6	Adobe Systems	121.4	7
7	Logitech	112.0	10
8	Software Publishing	110.4	8
9	Borland International	104.1	6
10	Aldus Corp.	87.9	9
11	Santa Cruz Operations	83.0	12
12	Electronic Arts	66.4	11
13	Mediagenic	65.5	13
14	Broderbund Software	51.0	14
15	Symantec Corp.	47.0	18
16	Phoenix Technologies	45.8	15
17	WordStar International	41.0	16
18	Index Technology	38.0	20
19	Digital Research	37.5	19
20	Softbridge Microsystems	35.6	31

***Soft-Letter*, a Watertown, Massachusetts newsletter, created this list of the top PC software companies, including only companies that create programs for personal computers, and ignoring those with connectivity products. Novell had a 1989 revenue of $422 million and would have placed third on the list. The combined revenues of Novell and Lotus in 1989 would have been $978 million, placing them at the top of the list.**

If the two companies do find secrets in each other's products that will enhance new programs, users will come out ahead.

And while the combination may seem like a triumph of size over innovation, it could have the positive effect of stabilizing networking standards, and thereby helping small, creative developers.

Chris Evans, president of daVinci Systems, said he hopes that Microsoft will become more flexible, which would be a big relief for him; he is in the e-mail software development business. Before this, he said, "there was always the possibility that Microsoft could roll you over as a small developer."

Evans also expressed the fears of many by saying that if the merger leads to an unchallenged software oligarchy, it could represent the end of PC software as a great frontier of creative expression. And that would be a loss for everyone.

Maxtor Buys MiniScribe

Maxtor, a major supplier of large hard disks, has saved MiniScribe from the throes of a Chapter 11 reorganization.

Both companies have good reputations for building high-performance disk drives in their respective fields, although MiniScribe has been floundering for a little over a year.

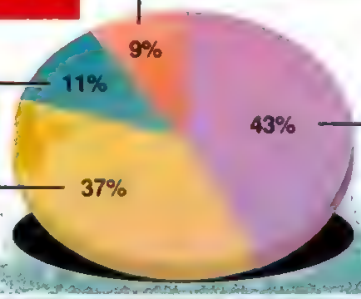
MiniScribe's woes were the result of some poor management practices designed to pump up revenues, which ended up falsifying sales figures instead. The company's 3.5-inch disk drives have been among the most popular on the market, though Conner Peripherals has taken the lead in performance breakthroughs.

Maxtor bought the company for $46 million and immediately opened up a $30 million line of credit to help the company get back on its feet. ■

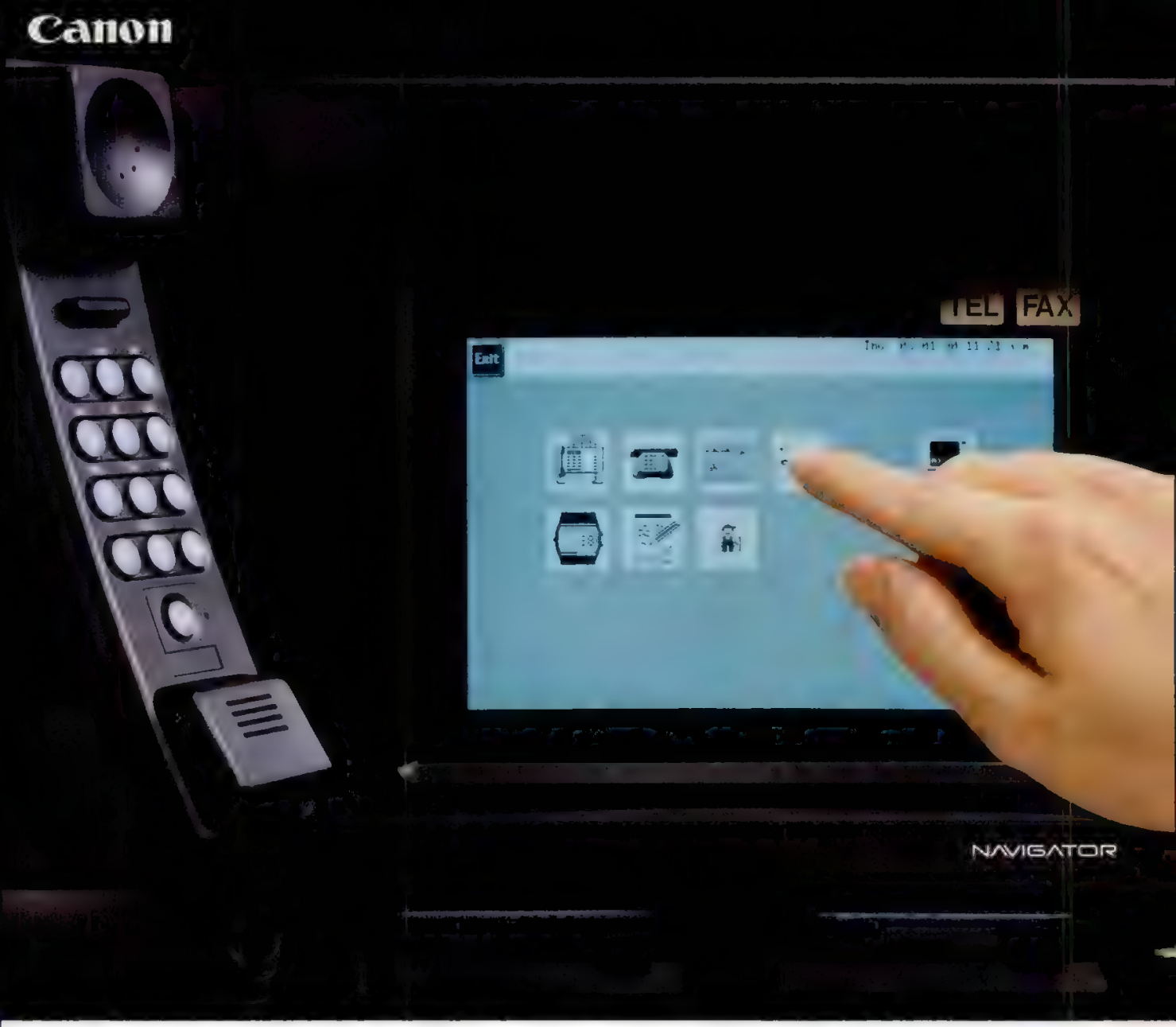
SURVEY

Sales of 386 software like *QEMM-386* and *Microsoft Windows 386* reflect the growing trend toward the 32-bit processors. And when you look at the most common applications for a PC, it's not surprising that three word processors are in this issue's Top Ten list plus an integrated program (*Microsoft Works*) with a word processing module. More than 1,100 people responded to this PC MagNet survey.

Which type of desktop PC do you use most often?



Which applications do you use on your PC?



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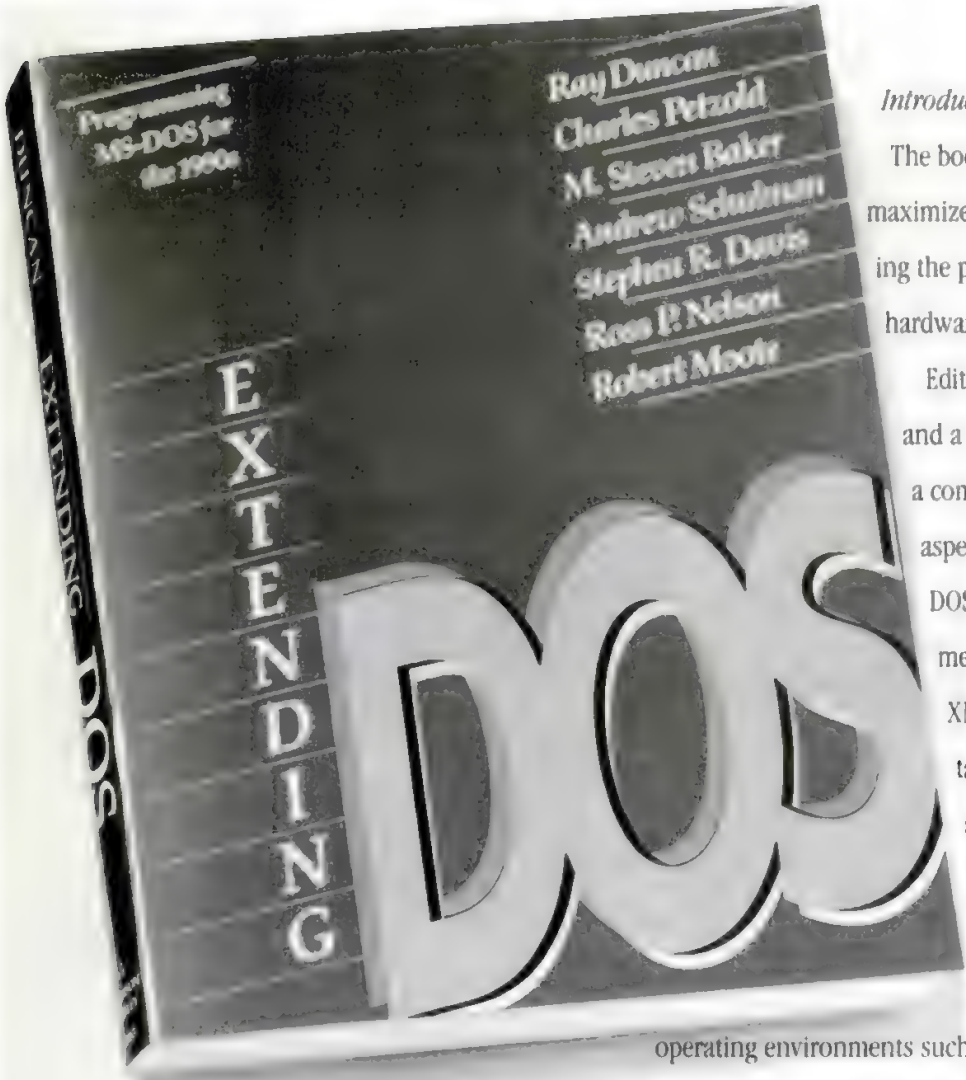

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Bill Machrone

Old Advice: The Best Advice

The seminal books on project management and programmer productivity were written nearly 20 years ago. Are they outmoded?

Any programmer or project manager who's been around the block can tell you about two favorite books: *The Mythical Man Month,* by Frederick P. Brooks, Jr.; and *The Psychology of Computer Programming,* by Gerald Weinberg. The strange thing is that virtually no other books on the subject come to mind, even though these were written in the early 1970s.

Through the '60s and early '70s, there was much discussion about programmer productivity, analysis and design, and task management. Then it all seemed to evaporate, although the problems have worsened. Yourdon and DeMarco have covered some of the ground, but mostly from a methodological standpoint. Has no one advanced the state of the art of programming and project management?

Or was I remembering these books through the rosy filter of retrospection? To find out, I reread them. I was surprised and pleased to discover that their insights on the nature of programming as human endeavor and its management were as fresh as ever. I also found them quaintly dated, given the utter nonexistence or even inkling of PCs.

History aside, I'm prepared to recommend these books to an entire new generation of programmers and managers. Perhaps if these books had been more widely read, some of the more infamous personal computer software debacles of the past year or two wouldn't have happened. Here's why:

These books sensitize you to the organizational dynamics, human factors, and Murphy-like laws that govern software development. Both are rich in aphorisms and rules that will come into your conversations.

IT'S THE LAW

Of the two, Brooks is the more required read. He has been called "the father of the IBM System/360." In three years' time, over 5,000 man years of work went into designing it. We're fortunate that the person charged with creating the quintessential business computer operating system is literate and introspective. His premise is clearly stated in the book title. Brooks wastes no time getting to the heart of the matter; the first chapter proves with examples and charts that merely thinking in terms of man months is an invitation to disaster. The book comes to an inescapable conclusion, now known as Brooks's Law: "Adding manpower to a late software project makes it later."

Not every task has to be the size of OS/360 for Brooks's book to be useful. He defines the inner workings of the tiger team, the small group of top performers that can seemingly program rings around far larger departments. He discusses the role of architectural integrity and how to get it; he points out something often seen, but not identified: the Second System Effect. That's where the members of the team are solving the problem at hand or one reasonably similar for the second time. Brooks observes that people tend to store up innovative ideas, features, and frills that wind up in the second system. The result is an overdesigned, overfeatured product that may perform poorly, yet at the same time be nearly impossible to program. Sound familiar?

ILLUSTRATION: JAY BELMORE

His prognosis for maintenance programming is grim: "All repairs tend to destroy the structure, to increase the entropy and disorder of the system. Less and less effort is spent on fixing original design flaws; more and more is spent on fixing flaws introduced by earlier fixes." Part of the trick, says Brooks, is knowing when to give up and start over again. *The Mythical Man Month* adds such awareness to

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your decision-making arsenal.

Weinberg, in *The Psychology of Computer Programming*, has an unending stream of aphorisms and anecdotes that deal with the human factors of programming. Maxims such as "Any program that works is better than any program that doesn't," and "Every large and significant program has 'just one more bug'" set the tone for the book, which takes you on a joyride of failed systems and bruised egos. Seen through Weinberg's perceptive eyes, each tale becomes an object lesson. He amply illustrates the importance of interaction and the obtuseness of management in inadvertently stifling it.

Every chapter ends with questions for managers and programmers; many of these questions could spark hours of productive office debate, or provide food for quiet reflection at home.

The Psychology of Computer Programming is like three books in one. The first two sections address the individual and organizational factors affecting programming. Like Brooks, Weinberg distills team dynamics down to the essence: "For the best programming at the least cost, give the best possible programmers you can find sufficient time so you need the smallest number of them."

The next section of the book discusses personality factors that make for a good programmer. This was a major issue 20 years ago, when IBM and others sold programmer aptitude tests to companies. These went well beyond the expected problem-solving skills and deeply into personality factors and personality testing. Although personality testing has fallen into disuse of late, Weinberg makes an excellent case. Maybe we should be using the tests before we hire programmers for critical tasks.

In the final chapters, Weinberg postulates the ideal programming environment and language. Given the date of the book, some of his notions seem naive, but they were some of the clearest thinking on the subject for its time. Overall, however, he makes some excellent recommendations on approaches to standards. Managers of shops that are hotbeds of individuality and idiosyncrasy would do well to study this chapter and prepare to get tough.

These books continue to stand out for a simple reason: they're still the best. ■

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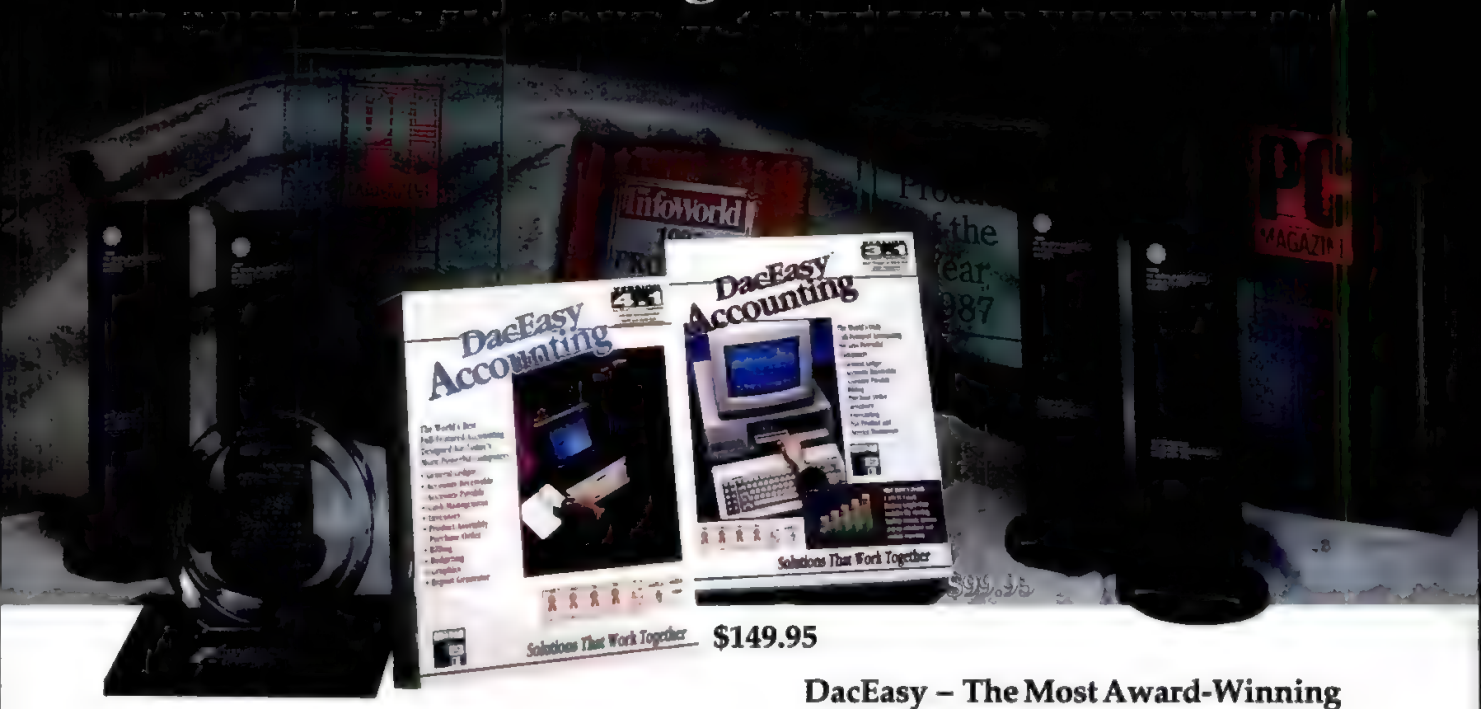

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John C. Dvorak

The Software Slop Factor

Too much of today's software is unacceptable. It's time for users to speak up.

Have you noticed that too many new software releases and upgrades are clumsy and amateurish? They look like rush jobs, with hokey front-ends, poor installation procedures, useless new features, and monstrous code sizes.

When did users stop complaining about sloppy programming and needless complexity in established programs? When did upgrades go from improvement of basic code to manic featurism? Was it with *Lotus 1-2-3* Release 3? Was it with *dBASE IV*? Is WordPerfect Corp. the culprit? Or Microsoft? Maybe someone out there knows.

Few vendors are improving the basic code of a software package. They do little to make it smaller or more efficient. This is because they assume all users are ignoramuses who aren't concerned with performance. All these users want, they'll say, are needless features.

The result is what you see: bloated software coded in clumsy mega-C or Pascal. The code size is up. The box weight is up. The number of disks provided with the package is up. Everything is up except for performance and convenience. Slop has set in.

Let's increase our awareness. Here are the five danger signs, the basic slop tenets that make much of today's software unacceptable:

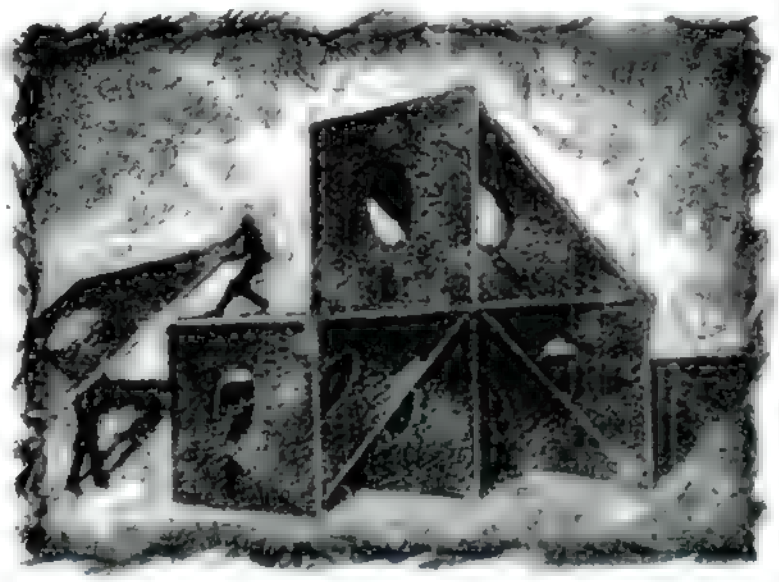
1) Ridiculous code size chewing up all available memory. I've seen too many word processors that are between 25K and 60K in code size to accept one that is 250K or larger. It's ludicrous. It's a bad sign. How does its publisher expect to maintain such software? Most incredible are the newer *Microsoft Windows* packages, which should theoretically be minuscule in code size, since *Windows* is sold as an I/O panacea for coders. You just call *Windows* routines. Funny, how these programs are even bigger!

2) A million files. I'm stupefied when I run into software that is so poorly written that the disks contain hundreds of overlays and drivers and who knows what. Finding an executable file on one of these disks requires a keen eye. Some of these packages are so lame that they can only be executed from a batch file! When you examine the batch file you see there are a dozen impossible parameters that have to be included to get the program to run. Pathetic.

3) Failure to save the state of the machine. It's annoying when a program fails to save the color settings and cursor type that you were using in a previous session. How rude! You run the package and then return to DOS to find everything changed. You never know what these programs are screwing up. When I see this incompetence in the course of reviewing programs, I flunk them right away.

4) Installation ineptitude. I've run into otherwise good products that have an impossible or naive installation procedure with virtually no error handling. Some of the programs themselves seem pretty good, but the installation is amateurish and almost insulting. They can't handle installing from drive B:, but never tell you that, or they can't install to drive D: or E: or whatever. It's ridiculous.

5) Nonsensical command sets. I no longer believe that every program should use the *WordStar* diamond for cursor control (although I still prefer it). But I would like to see software writers use commands that make sense! I can't tell you how many packages I look at that seem as though the command set was dreamed up by a lunatic.



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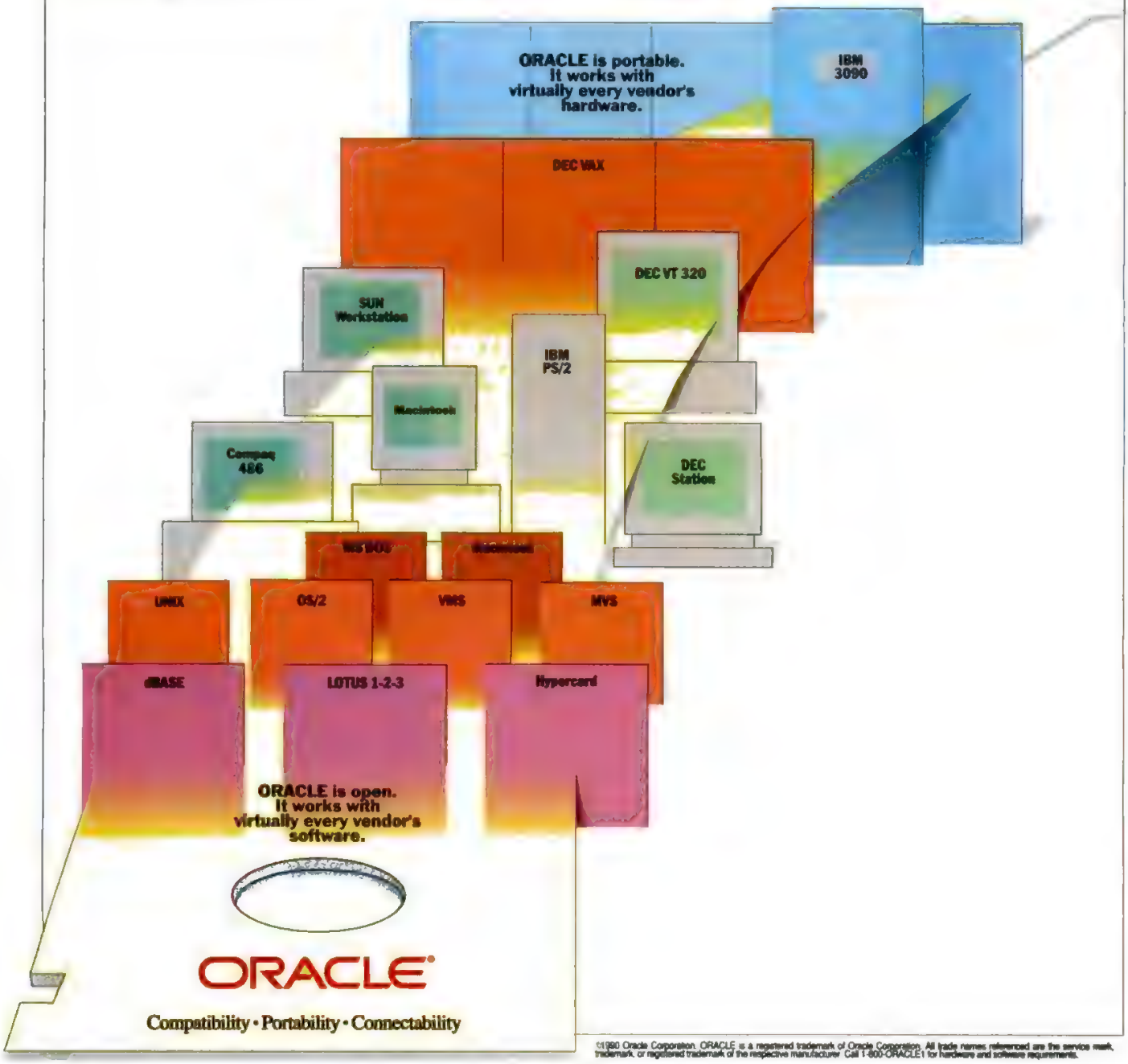

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Inside Track

Chip Wars Heat Up Dept. Intel, Intel, Intel. That's all we hear about. What's the latest? Lots! First of all, apparently the company is concerned about the latest **kink** in its armor: add-in math coprocessors made by other manufacturers. Weitek started the trend, but for the last year a slew of upstarts have announced 80287 and 80387 substitutes. To counter this trend, Intel may ship a **new version of the 386,** which like the 486 will have the coprocessor on the same silicon. This will keep the price low and speed up the math processing. Some think Intel may even release a 386SX/M, which would be a 386SX with a built-in coprocessor. This maneuver will effectively **stall** the competitors and probably bury a few companies.

For users it might mean a cheaper system. I guess that's the benefit. **More integration** will follow. Intel isn't stopping with a combo chip. Concerned about the need to **up the clock rate** in its future generations of chips, it knows that the support circuitry is going to become a problem for systems designers used to off-the-shelf parts for their designs. The upcoming 50-MHz 486 is the primary concern. All sorts of special circuitry is needed to make it work. The idea is to reduce the support circuitry to a chip or two or, ideally, put it on the same piece of silicon where the 486 resides. Anyway, why should all these VLSI houses make any money?

> According to Intel, the 80786 will be released around the year 2000, and do 2 billion instructions per second. Hang on!

The increasing clock speed is a **real issue** in design circles, since speeds are entering into the bandwidth of television, and RF problems increase with increased speed. Each new generation of chips starts at a higher clock speed than the previous generation began with, and just gets **faster and faster.** The 8088, for example, began at 4.77 MHz. The 286 started at 6 MHz, the 386 at 16 MHz, and the 486 at 25 MHz. The 586 will probably come out as a 50-MHz chip.

To keep tongues wagging, Intel began publicly discussing—of all things—the 80786 as it rolled out a ten-year plan. This chip disclosure was obviously meant to assure the community of two things: a continued commitment to CISC architecture, and proof to the pretenders that any attempts to clone the Intel chipset will be **futile.** Most observers agree that right now Intel is **more like Boeing** than like a chip fabricator. Its microprocessor capability and infrastructure are best compared to Boeing's ability to build 747's. You can't do a start-up business and hope to jump into the airplane business and compete with Boeing. Even long-established aerospace companies have difficulty competing with Boeing. Lockheed with its L-1011 comes to mind.

But **cloning the proprietary 386** would be a bonanza for anyone who could do it today. So upstarts are ignoring the reality of Intel's in-the-catbird seat position. The most talked about newcomer is a company named **NexGen.** NexGen and other new companies are supposedly trying to clone the 386 or the 486. Further, **rumors from Japan** keep suggesting that a Japanese clone will show up any minute. Unfortunately, the leading Japanese microprocessor company, NEC, shows no signs of coming out with such a breakthrough. One California chip foundry supposedly has a two-chip 386 that comes close to working.

Meanwhile, **Compaq has invested** in NexGen, hoping to get out of Intel's **stranglehold** and fearing that Intel will concentrate more and more on its burgeoning systems business in direct competition with Compaq and others. The rumor in the valley is that Intel has deprioritized Compaq for much-needed microprocessors to **punish the company** for insubordination.

Chip makers have traditionally been unbusinesslike in shortage situations.

Anyway, back to the 786. This chip will be a lulu, if it's ever produced as discussed and is not a lot of hot air, a gag, or just pie-in-the-sky **dreaming.** The 1-inch by 1-inch **monster chip** will be mostly cache, 2MB to be exact. It will contain what looks like four or more 386/387s in parallel, a couple of vector processors to deal with parallelism, and a **DVI video module** for some unknown reason. I suspect the DVI aspect will be dropped, as recent developments in real-time video and compression technology are leading away from DVI already.

In the meantime, insiders are flocking to a company called C-Cubed, which has developed a real-time compression scheme that does what DVI does, only **cheaper and better.** Or so they say. Intel is aware of the C-Cubed technology and doesn't know what to do about it.

Intel says its 2-million-transistor 586 will show up in 1992, and the 4- to 6-million-transistor 686 in 1996. **Will this madness ever end?** By the year 2000, the expected technology breakthroughs will allow the company to have **100 million transistors on the 786.** It will crank out **2 billion instructions per second at a clock speed of 250 MHz!!!** Sheesh. The company confirms these assertions.

Think about it. This means that processing power will be easily doubling every year during the next decade. It boggles the mind; it sounds nuts. Like someone said to me, "Man, I'll bet ***WordStar* will run real fast** on that chip." Yes, and I'm sure all the other 8088 code (much of which is still being written) will run real fast, too!

I wonder if they'll ship a **100-MHz 8088** by then. ■

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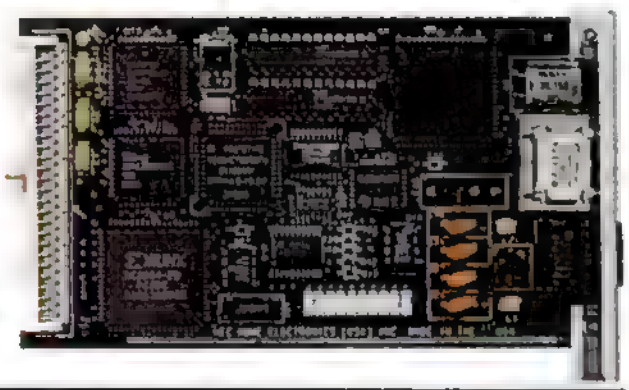

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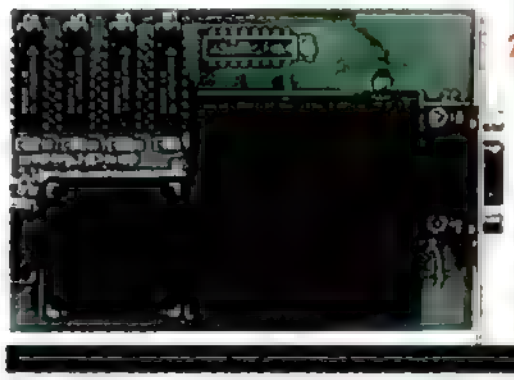

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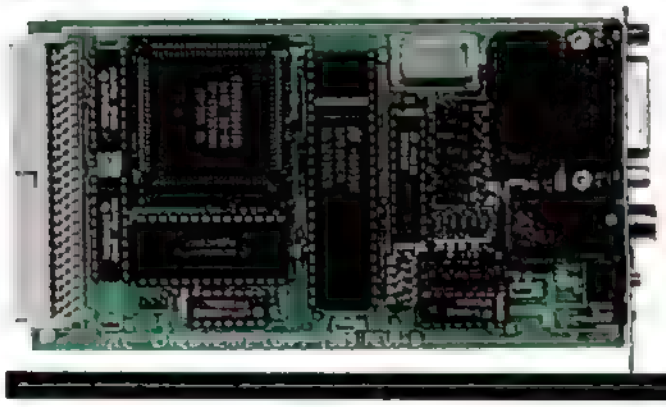

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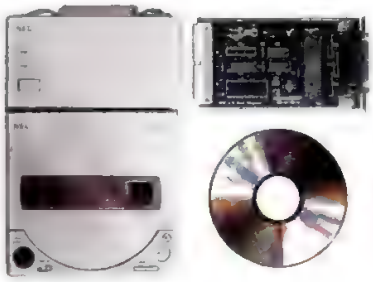

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CIRCLE 347 ON READER SERVICE CARD

Jim Seymour

Software That Leaves Our Needs Behind

The simple truth is that we don't always need more functionality in our software. Many of us often need less.

Something strange is happening these days to one of the basic premises of the PC business—or at least, to one of my favorite theories about that business. And it makes me very uncomfortable.

From the beginning of the PC revolution, PCs have been about empowering the individual. By giving us the tools to do jobs that formerly required a large computer, PCs have given us more control over our lives and over the scope and quality of our work.

Most of that power comes with a pretty high return. Take financial analysis with spreadsheets, a function that's well suited to interactive desktop computing. Computer-savvy analysts once spent hours constructing programs to perform a kind of analysis far more feeble and remote than what is now so easy with PC spreadsheet software. Writing all those lines of SET files and statements was enough to drive us crazy—and enough to drive us to PCs, which brought power right to our desks.

In too many areas to count, PCs have forever reversed that model, bringing us the power we need to do our jobs better.

But there is an intersection of two curves out there somewhere—the curve of ever-increasing software power and the curve of the far more gradual change in the nature of the work most of us do—that suggests that when PC software becomes so powerful, so feature-laden, it can leave behind many users.

DISABLING SOFTWARE

Rather than aiding us by creating more-sophisticated products, some software today ends up alienating us. Users drop out, convinced that if what they want to do utilizes only 10 percent of the program, they've got the wrong piece of software.

This is arguably a dangerous notion, and certainly an unpopular one in the software business. The curve of binding energy in the industry, to borrow a phrase from John McPhee, is all about ever-increasing speed, power, and functionality. That's what keeps us upgrading our old releases of established programs—and also what gives new programs that critical edge that may let them squeeze onto the Softsel Hot List. In other words, it's what *sells*. Or so goes the conventional wisdom.

But the simple truth is that we don't all, and don't always, need more. Many of us—even sophisticated PC users—often need *less*.

This was brought home to me during two recent demos of new software packages: Symantec's project manager, *Time Line*, and Microsoft's first IBM PC version of its desktop presentation program, *PowerPoint*.

I loved 'em both. Actually, I was biased: I admire *Time Line* so much that I've used it myself on the PC almost from its introduction. And *PowerPoint* on the Macintosh is one of my regulars, too: it defined our expectations for a whole new category of software.

So my reaction to these early-look demos wasn't based on not liking the programs.

But in both cases, my reaction was the same:

ILLUSTRATION: JAY BELMORE

my Gawd, what about the people who need only a *tenth* of that functionality?

A great deal of what people use a product like *Time Line* for is really project planning. They want to be able to list a series of tasks, move them around into plausible sequences, and then print tidy Gantt or PERT charts.

In effect, they want to work out a time line on the back of a metaphorical electronic envelope. They're not going to use the program to

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actually manage a project, only to assess whether that project layout makes sense.

In other words, a very large percentage of first-time buyers of packages like *Time Line* want something vastly simpler than *Time Line*. They buy anyway, assuming they'll be able to use only the tiny subset of the program's features they really need. They then discover that the program's richness and power *of necessity* mean that the learning/using curves are too steep for people who want to use only 10 or 15 percent of its power.

The new version of *PowerPoint* falls into the exact same trap. It's capable of producing the most astonishing, complex, gorgeous, and memorable PC slide shows—or, better still, real 35mm slide sets—you've ever seen.

Yet as even Lewis Levin, manager of Microsoft's graphics group, admits, maybe 80 percent of the users want only to be able to turn out a few nice overheads for a meeting that's coming up in a few minutes. They want one or two large, attractive typefaces, and they're going to print those overheads in black on their LaserJets.

Sure, you can do that with *PowerPoint*. But with such an abundance of rich tools in the program—a program written to do something else entirely—you'll stumble around a lot in the process. You may well miss the beginning of that meeting.

A SMALLER, GENTLER PRODUCT

The problem doesn't lie with these programs but with the range of programs available today. It would make a great deal of sense for Symantec to offer a second, far simpler and less expensive package for those who just want to plan a project. And it would make a great deal of sense for Microsoft to offer a second, far simpler and less expensive package for those who just want to knock out a few overheads, fast.

But I don't think we'll see those products anytime soon.

There is hope, however, for those of us who need our powerful and complex tools for the big jobs—and need to mix in some smaller, simpler tools for, well, smaller and simpler jobs. In my next column, I'll tell you about a company selling that kind of product, and how much I've come to rely on a few of its gems. ■

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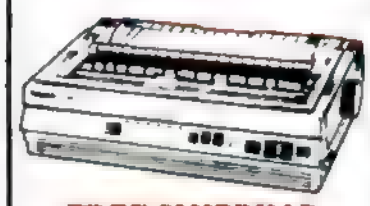

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William F. Zachmann

The Real-world Problems With Unix

Unix isn't quite the standard it's made out to be. That's a big advantage for OS/2.

In my last column I identified some of the obstacles standing in the way of OS/2's acceptance and recommended that both Microsoft and IBM do more to remove them. Without their action, I suggested, it is possible that OS/2 will not be successful.

Clearly, if Microsoft and IBM fail to establish OS/2 as the heir to DOS for office systems, Unix will be the primary beneficiary. Worsening prospects for OS/2 translate into better prospects for Unix.

But don't chill the champagne for Unix's victory celebration just yet: as an operating system standard for office desktop PCs, Unix has problems of its own.

First, contrary to claims made by its enthusiasts, Unix is far from being the single standard that it is sometimes made out to be. Granted, considerable progress has been made toward standardization among Unix versions over the last ten years. Nevertheless, Unix remains a more heterogeneous collection of implementations than you might expect.

To a certain extent, this situation is a result of one of Unix's much-touted strengths: it is already supported by a number of incompatible hardware platforms. What this means, however, is that binary code for applications is not portable across all Unix implementations.

The idea that source code for Unix applications can be recompiled for various hardware platforms remains, in principle at least, a far leap from the kind of off-the-shelf compatibility that has characterized DOS software products and will characterize OS/2 applications as well.

One of the most important strengths of DOS has been that it wasn't just a software standard—it was a hardware standard as well. The architecture of the IBM PC, XT, and AT, designed around the Intel microprocessor architecture, was as much a part of the standard as was DOS.

That combined software/hardware standard created a common platform for software developers, allowing them to generate object code that would run on a wide variety of systems and creating for them the enormous market for applications.

MARKET FRAGMENTATION

While it *is* possible to run a particular Unix version on a wide variety of 386- and 486-based systems, the overall Unix market is far more fragmented than the DOS market has been and than the OS/2 market will be. Not only are there competing versions of Unix, even for Intel-based systems, but there are numerous implementations for other architectures that are not compatible at the binary level with one another.

Unix partisans, of course, emphasize the virtues of being able to run the operating system on various hardware platforms. They argue that this should make it much easier to take advantage of, for example, the superior performance of newer, RISC-based microprocessor architectures.

ILLUSTRATION: JAY BELMORE

However, in reality, the newer architectures have not yet delivered practical price-to-performance ratios that are significantly superior to those of the more recent versions of more traditional architectures like Intel's. By the time they do (and *if* they do), chances are good that portable versions of OS/2 will be available as well.

Yet another dimension of Unix market fragmentation is reflected in the plethora of com-

peting, incompatible graphical user interface (GUI) alternatives for Unix, in spite of the existence of the low-level *X-Window* standard. *Open Look* from Sun Microsystems and AT&T vies with the *OSF/Motif* GUI from the Open Software Foundation. And then there is also Steve Jobs's *NextStep* interface, as well. All three are competitors for the loyalties and energies of not only users but also of software developers. The result is that the Unix standard remains elusive in practice.

Then, too, there is the matter of compatibility with existing DOS applications. The various DOS-under-Unix options have not turned out to be as usable in practice as they appeared to be in theory. Even OS/2's often-maligned DOS compatibility box of early versions has done a much better job at running DOS applications than the Unix-DOS merge alternatives.

As OS/2 gains substantially improved capabilities in running DOS applications, Unix alternatives start to look far less appealing as a migration path for DOS users. The transition to OS/2 comes far more easily.

That is also due, in part, to the similarity between OS/2's underlying command structure and that of DOS's familiar C:\> prompt. Learning how to use OS/2 isn't very difficult for reasonably sophisticated DOS users. Unix, however, remains a strange and foreign environment by comparison.

Further, contrary to what many think, growing use and improved versions of *Microsoft Windows* have actually strengthened OS/2's prospects rather than weakened them. That's because it is even easier to migrate to OS/2 from *Windows* than it is from DOS. *Windows*'s recently enhanced capabilities, far from hurting OS/2 in the long run, serve instead to smooth the way for its adoption.

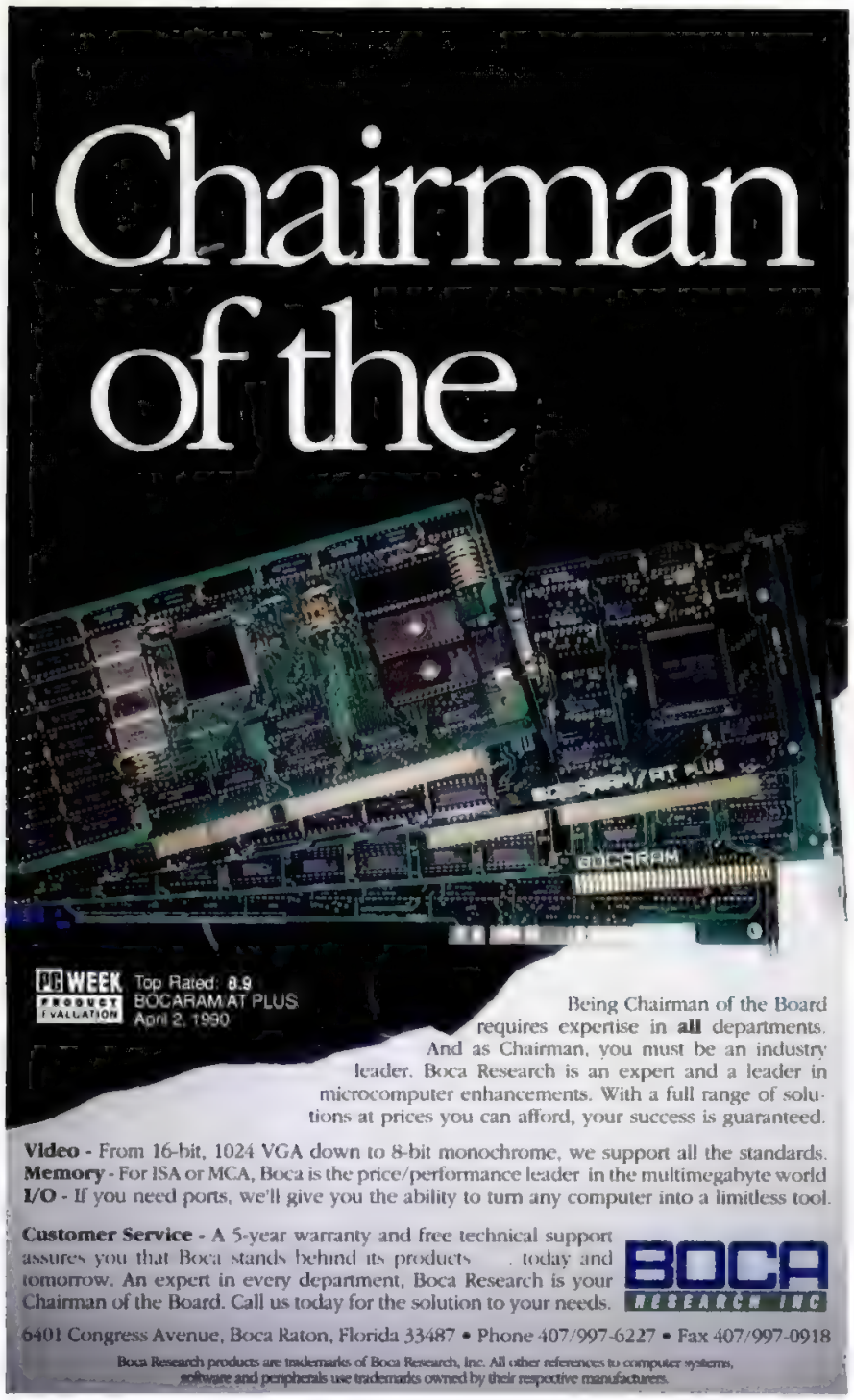
DOWN FOR THE COUNT?

Lacking a knockout punch for a truly decisive victory over OS/2, Unix's prospects for success remain limited. OS/2's DOS-related heritage naturally gives it an advantage in the vast majority of user sites. Even though current use is still modest, OS/2 is already in place as the successor to DOS.

Like an army trying to take entrenched positions from a defender, Unix will need both superior numbers and weaponry to prevail. As it stands, however, the sides are about even.

So, despite the questions that I have asked and will continue to ask concerning OS/2, let there be no doubt that I believe OS/2, rather than Unix, remains the heavy favorite as DOS's successor. Far more drastic events than anything we've seen so far (and more than minor missteps by Microsoft and IBM) will have to occur for that to change.

In fact, I'm still willing to reaffirm the prediction I made in January: the acceptance of OS/2 will sharply pick up speed before the year is done. With more applications appearing monthly and more users moving to more capable 386- and 486-based systems, OS/2's prospects are likely to improve, perhaps quite dramatically, in the months ahead. ■



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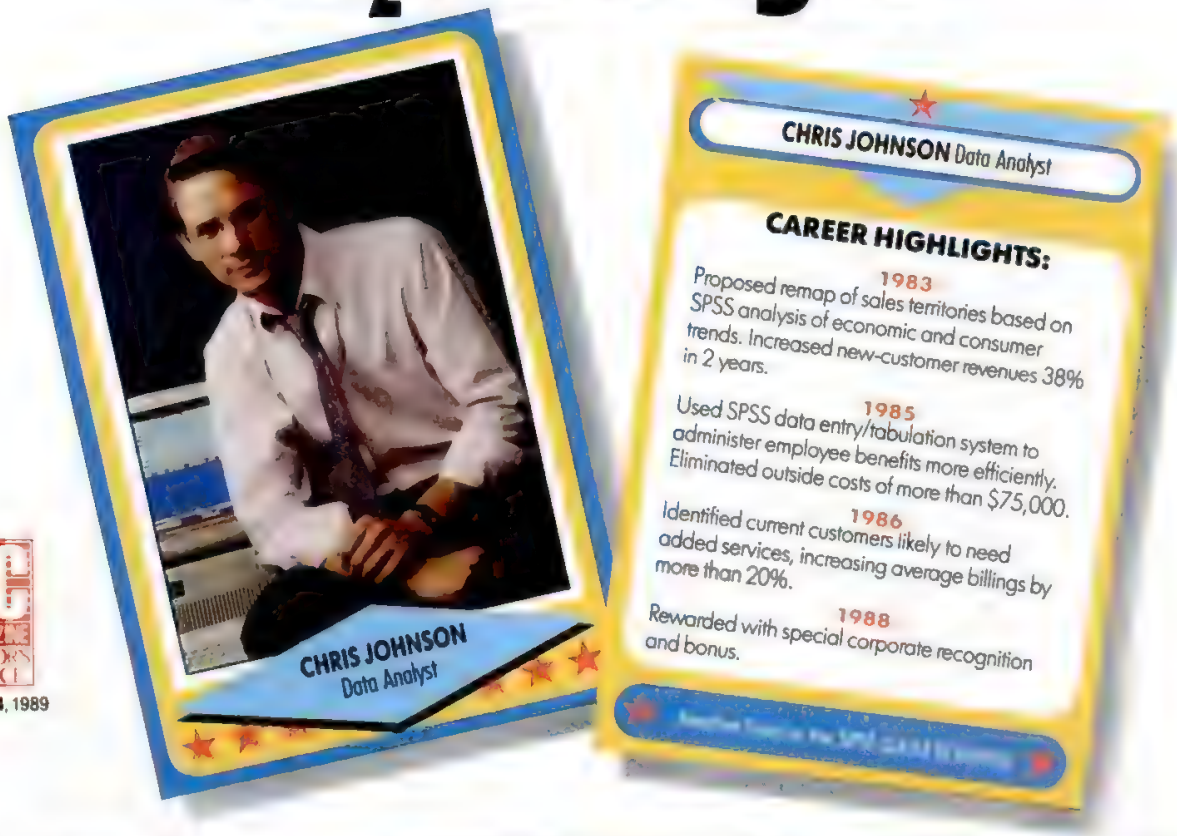

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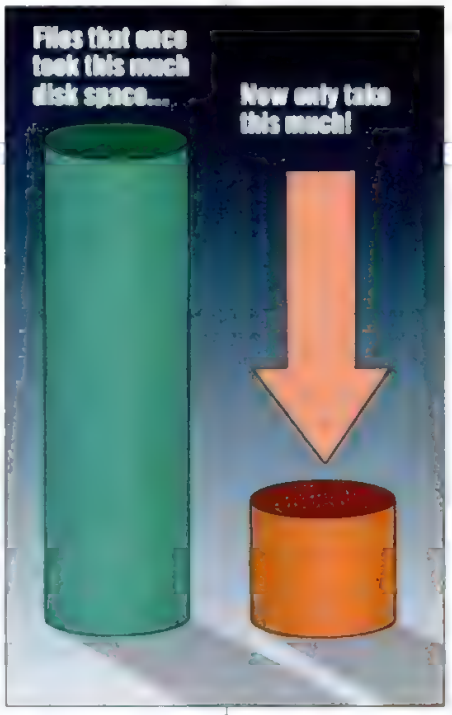

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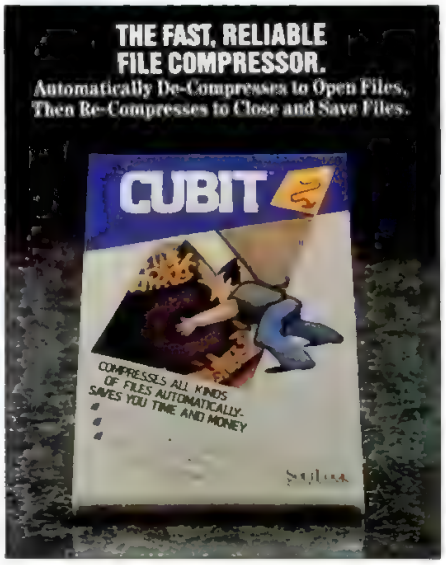

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So, Who Needs Disk Optimizer, Anyway?

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But unfortunately, DOS is doing its best to slow hard disks down — by breaking files up into pieces. Storing different chunks in different places. As a result, loading is slower. Sorting is slower. Everything takes longer because your hard disk has to chase around picking up and laying down different pieces of your file.

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Lately, we've heard some people are reluctant to un-fragment their disks for fear they'll lose data if something goes wrong in the process. But have no fear with Disk Optimizer. Nothing will go wrong because nothing *can* go wrong. Even if you yank the plug from the wall in the middle of the program. It's because only Disk Optimizer is designed to copy each file, piece by piece, then thoroughly check the un-fragmented version for completeness and integrity. Then — and *only* then — does it go back and erase the fragmented version.

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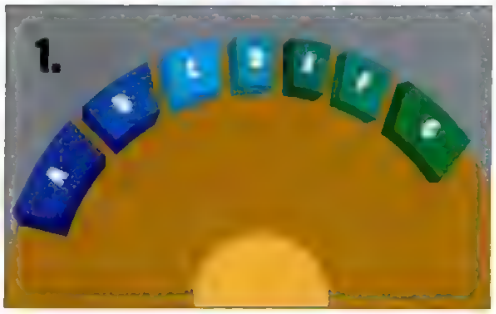
1. The New Hard Disk.

This is a brand new hard disk. As you begin to create files, they are stored on the disk randomly. Each occupies a place on the sparsely-populated disk. At this point, disk performance is at its peak. A 256K file or program can be retrieved in just a few seconds. Wear and tear on your equipment is minimal.

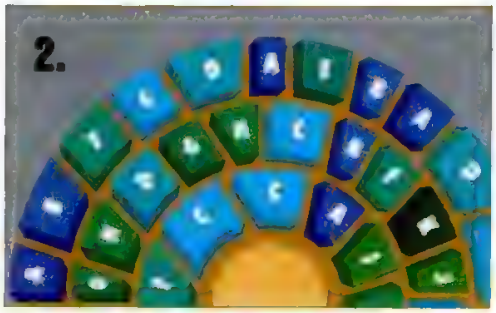


2. Fragmentation Begins.

As you edit these existing files, DOS will store your additional data in the same random manner. If you delete a file, a "hole" is left where that file had been stored. DOS will fill that hole with parts of other files. Fragmentation has begun. Your hard disk is running considerably slower.

More and more files are added, edited and deleted. There are pieces of your files and programs scattered all over the disk. Your hard disk's head spends more time "dragging" across the surface of the disk, endangering the media — and the data.

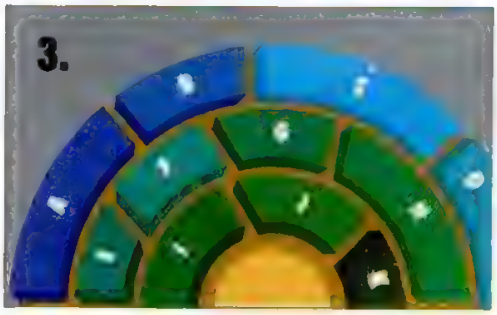
Under these conditions, the risk of a hard disk crash is high, and the wear and tear on your disk's moving parts and magnetic media is severe. And it's slower than ever!



3. After Using Disk Optimizer.

Disk Optimizer assembles the pieces of your fragmented files and stores them as ONE FILE. Just a couple of keystrokes will help your hard disk run up to 300% faster! And all of your data is 100% safe. Your hard disk and your data are safe.

Disk Optimizer contains features such as "Data Guardian," that can recover files and unformat accidentally formatted hard disks — plus a dozen new utility features.



Over 250,000 users ha discovered that Disk Opti saves time and money while providing complete pro from hard disk errors and era

Maintenance Features:

- **TrackSaver.** Protects the surface of your disk from ex wear by preventing the head of the drive spinning over the same track for too long.
- **Refresh.** Prevents bad spots that develop on disks du fading magnetic charges. It's like a tune-up your hard disk.
- **Advanced New 'Data Guardian.'** Instantly restores an accidentally deleted fil directory or hard disk — up to 255 days after was erased! Accidentally format your hard disk? Just select Data Guardian's UNFORMAT feature and it's instantly restored!
- **Analyze.** Graphical displays show how much fragmentation has taken place on your hard disk.
- **KillFile.** Completely delete sensitive files to prevent unauthorized access.
- **FindFile and FilePeek.** Misplace a file? FindFile will perform a "wildcard" search with just a couple of keystrokes. Then get a "quick look" with FilePeek.

SOFTLOGIC SOLUTIONS

MW 3280 Disk Optimizer 4.0 5¼" $69.95
MW 3285 Disk Optimizer 4.0 3½" $69.95
Runs on IBM PC and compatibles. Supports DOS 2.1 and above.

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- **Dictionary!** The 400-page, 4,500 entry, *Webster's New World Dictionary of Computer Terms.*

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Four different "learning centers" provide an entertaining, informative experience. This program was awarded The Software Publisher's Association "Best Home Learning Software of 1987."

Awarded The Software Publisher's Association "Best Home Learning Software of 1987."

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MAVIS BEACON TEACHES TYPING! begins by outlining the lesson plan and evaluating your typing for speed, accuracy or particular problems. A chalkboard appears on the screen displaying Mavis Beacon's comments. From there, each lesson is custom designed to work on these problems. If your speed is poor, MAVIS BEACON will prescribe drills for increasing speed. If accuracy is your weakness, MAVIS will help you work on the problem keystokes.

Includes FREE Resume Writer!

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FAMware Computer Software For The Family

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Plan for the future, control your finances, weigh financial alternatives — and stay organized. Family Fortune package contains 10 useful programs. It answers financial questions in seconds — so you can make sound decisions.

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Family Fortune also keeps track of your family's stuff... from video tapes to magazine articles and immunization records. Make a household inventory list.

Family Fortune can also help you organize and analyze loans, prepare charts and create slide shows, sort and merge names, addresses and other pieces of information.

...Organize and Document Your Family's History and Records

A Complete Genealogy System for Your PC.

Turn your home PC into a genealogy lab and provide hours of enjoyment for the entire family. FAMILY REUNION organizes important documents and events in your family's history (birth, marriage and death certificates, descriptions of events, etc.) and creates a database of the information.

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With FAMILY REUNION, you can print a chart tracing your direct ancestors for up to six generations on a single page. Prints the direct descendents of any selected ancestor in a variety of formats: direct line, descending tree, columnar or side-by-side. Organize family reunions and print address labels for everyone.

Children can develop a sense of personal history by researching and organizing individuals and events. Great for class projects, gifts and as a keepsake for *their* children.

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Re$ume Professional helps you gain that edge with every résumé you prepare and send. It automatically does the legwork (and even some of the thinking) when you need customized, well-printed sheets. And it's a great tool for preparing and updating corporate biographies for distribution to the media.

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Re$ume Professional is the new version of the very successful Re$ume, in use worldwide by government agencies, universities, major corporations — even professional résumé services. Because this exceptional résumé software allows complete flexibility to customize your résumés, you focus on strengths and breadth of experience that are of particular concern to the reader. And only Re$ume includes accepted standards for style, layout and flow, so no matter how you arrange your information, your résumé remains technically correct.

Each Year, 3 Out of Every 10 Americans Change Jobs...

...Which means there are opportunities opening up every day. To get your shot, you've got to cover a lot of ground. With Re$ume Professional's easy operation, you can create pertinent, professional résumés and have them on their way — without delay. And make no mistake, every minute counts. Your finished résumés are accessible by most word processors for editing.

Access to "Skill Catalogs."

Re$ume Professional will automatically create high-quality résumés with chronological and accomplishment formats, complete with career objectives. In addition, it includes a list of commonly used skills that can be inserted into your résumés. Then, Re$ume will highlight your special abilities and unique talents. This "skill catalog" concept saves hours of wrestling with terminology, and each skill you acquire can be instantly added to your personal history for use in future résumés.

The Importance of the Database.

By storing and cataloging your personal history, experiences and specific marketable skills, you'll have instant access, in various formats, to your career history and significant events. Without the power of the database, you'd simply be filling out standard résumé formats — on your screen — and printing them. Re$ume Professional makes it simple.

The Standard Résumé.

This format creates a standard résumé following accepted standards for design. Just enter the appropriate data using Re$ume's sleek data entry screens, and in seconds, you'll have a résumé customized for your particular needs. This type of résumé is helpful as a general overview of your career.

The Chronological Format.

This format is used for establishing a solid history of performance. Re$ume Professional tracks events by date, including pre-determined skills where appropriate.

The Accomplishments Format.

The accomplishments format allows you to specify and include significant milestones in your career, without following a time line.

Versatility.

All three of these formats can be easily created using the same data and skill information. This allows you to gear each résumé to your specific job target.

On-Line Help and Loads of Useful Tips...

Re$ume has built a solid reputation for speed and accuracy for anyone who prepares résumés. Now Re$ume Professional adds more time-saving features and a variety of professionally-written cover letters that can be quickly edited using its advanced, on-line editor. This program has been used extensively as a teaching tool for résumé writing by professional résumé writers, guidance counselors and others. Professionals will enjoy the powerful database, and the ability to produce profile résumés for an endless variety of specific audiences immediately, without data entry for each use.

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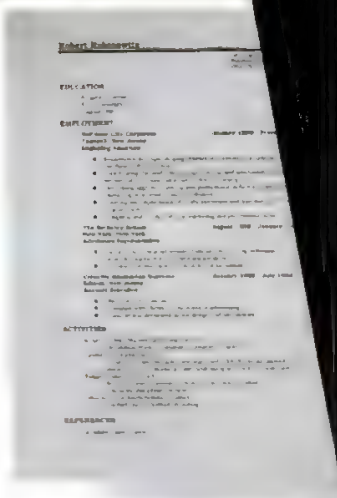
Re$ume Professional **$79.95**

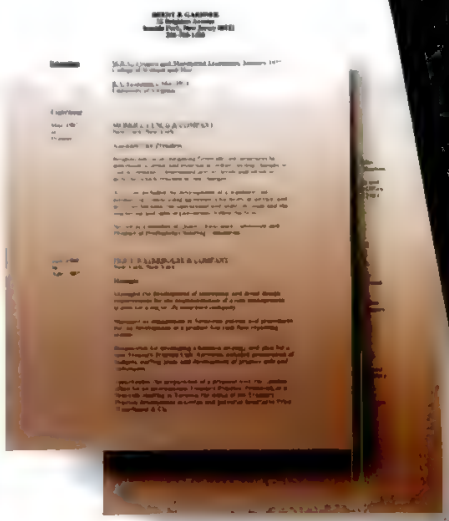
MW 3940 **Re$ume Professional**

5¼" & 3½" **$79.95**

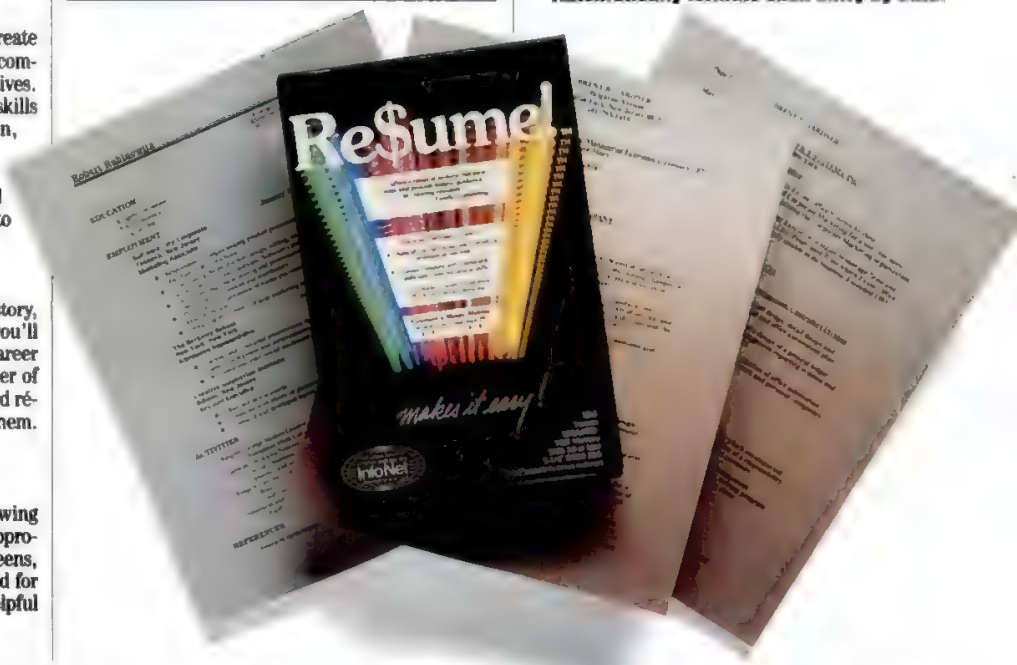
IBM PC, XT, AT, PS/2 and compatibles. 192K RAM, DOS 2.0 or higher, 80 column printer.



The Standard Format. Outlines education, experiences and o information. Ideal for general use.



The Chronological Résumé. Automatically formats each entry by date.



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ompaq 386!

natched a stock IBM PC XT, !, against a stock Compaq esults were astounding — the paq in a standard data transfer mark.

ate?

porates the proven speed-enhancing f 'disk caching' and adds an innova- ST! includes a form of 'intuitive logic' anticipates what data your CPU will , and reads that data from your fixed or e into a special RAM buffer (or "cache") RE the CPU asks for it!

result, your CPU spends virtually no time waiting for disk reads — an inherent logjam lows processing time significantly.

nd using FAST!, you'll notice that the more -intensive the application (database, for exam-), the more time FAST! will save — and the ster your applications will run.

And since FAST! reduces drive read time so dramatically, it also reduces wear on the disk drive — extending its life.

On a standard data transfer performance test, FAST! is 18 times faster than a standard AT — and 5 times faster than the leading competitor. In fact, and IBM XT with FAST! is faster than a Compaq DeskPro 386!

Don't Buy More Equipment!

You could spend thousands of dollars trying to achieve the speed required for truly efficient computing. Items like high-speed drives, turbo boards — even complete system upgrades try to overcome your system's inherent slowdown — waiting for disk reads.

FAST! is the only product that eliminates this processing tie-up and gives you top performance using only 8K — for $99.95. And FAST! will work with conventional, extended, or expanded RAM.

Imagine What FAST! Can Do for a 386!

FAST! will deliver spectacular results on your IBM PC, XT, AT and PS/2, but imagine how much faster the "new generation" of ultra high-speed processing technology like the Compaq 386 or Intel's 386 Above Board will run using FAST! — they instantly leap into a new computing class!

In addition, FAST! supports 'hot key' controls for instant response and installation — saving even more time and allowing you to be more productive, FAST! supports EXPANDED memory — but is not required!

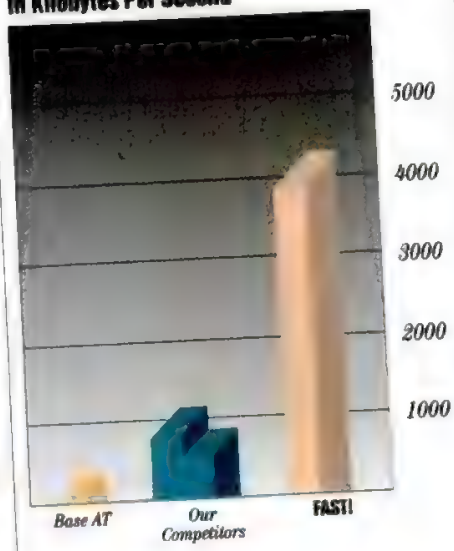
Our Performance Benchmark...

The technicians at TigerSoftware tested FAST! by matching it against the power of the 386.

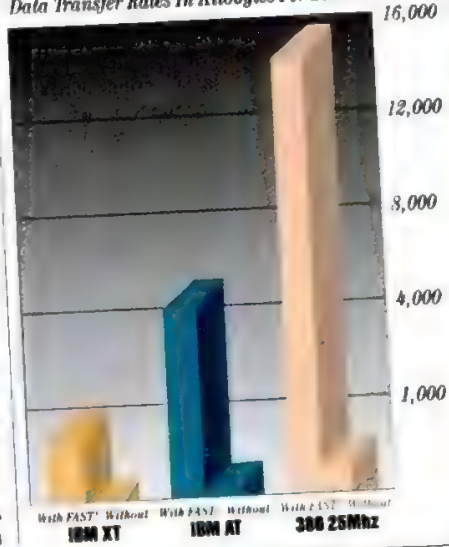
They took an ordinary XT with a 10mb hard drive and loaded FAST! Alongside it, a Compaq 386, 25Mhz speedster. The task: transferring a few megabytes in a standard performance benchmark.

The XT with FAST! outran the Compaq by over 3 seconds! Here are the results:

Data Transfer Rates In Kilobytes Per Second



With FAST! vs. Without FAST!
Data Transfer Rates In Kilobytes Per Second



CLOSE-UP

"Disk-Caching"

FAST! uses a RAM management technology called "intelligent caching" to eliminate downtime from the central processor's performance.

Improvements in processor technology have brought about CPU's with blazing speed; however, their real performance is limited to that of the slowest component in the system. Floppy and fixed disk drives, which have much lower data transfer rates than the central processor, are notorious for the drain they impose on the overall system performance.

FAST! works by "uploading" data into a RAM cache before the CPU calls for it. While this RAM management technique is not unique to FAST! (in fact, it's been employed by mainframe applications for years), the particular genius of FAST! is its ability to find and load significant file data rather than merely reading in sectors of data randomly. This "intelligence" is the key to why it offers performance vastly superior to other caching software products.

FAST! also represents a superior alternative to hardware upgrades like turbo boards, enhanced processors, and high-speed drives, at a fraction of their cost. Given the virtually infinite combinations of hardware configurations and applications programs, FAST! will provide different performance enhancement specific to each situation.

You'll be astonished by the improvements in your desktop publishing, word processing, and graphics software performance. You'll find that any software runs faster with FAST!, even DOS. It also eliminates wait by saving files instantly to the RAM cache, downloading to disk only at opportune times, rather than holding up processing speed. And FAST! enhances even floppy-based systems, without hard drives. There's simply no better or more cost-effective way to enhance your system's speed.

FAST! Disk Utility **Just $99.95**

MW 3850 FAST! 5¼" $99.95
MW 3855 FAST! 3½" $99.95

FAST! will run on the IBM PC, XT, AT, PS/2 and compatibles with 128K RAM and DOS 2.1 or greater. Supports fixed or floppy disk systems, and supports conventional, expanded or extended memory.

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► The Sleekest Menu.
► Fast, Simple "Move & Copy."
► Detailed Labeling & Cataloging.

You Won't Believe How Fast and Easy It is to Use!

Instant One Keystroke Access to Programs.

Most PC users, no matter how advanced, hate the time-consuming gobbledegook-like commands involved in accessing their programs and files. You have to type a backslash here, a cryptic command there, then wade through directories and subdirectories to get to work. And if your hard disk fills up, moving files involves more complex commands and tedious operations. Sound familiar?

That's why busy computer users everywhere are turning to DiskVision. This innovative 3-in-1 system completely eliminates the ridiculous requirements of DOS.

Power Up and Go!

Just turn on your computer, and up pops a clean, simple menu of everything loaded — all of your programs and files. Simply select the program you want — and it's up and ready to run. Looking for a particular file? No problem. Just open a list of files with one keystroke — and select the one you need. DiskVision gives you complete control of all files and programs on your floppies or hard disk.

And when the hard disk is filled to the brim, just tag older or dead files — from the menu — and one keystroke moves them instantly to a floppy, prints a label, then asks you if you want them erased from the hard disk. It's remarkably simple, and you'll always know where the files are. If you need one of the older files at any time, one keystroke instantly loads it back onto the hard disk

A Sleek, Simple Menu.

A simple, no-nonsense point-and-shoot menu selection can call any program on the system, no matter where it resides. Programs can be on hard disk, on a floppy disk or on the network. The user does not have to learn the complexities of calling and running each and every program.

Menus may contain up to 16 selections. Selections can be programs, or an unlimited number of subordinate menu pages.

Move and Copy Files Without DOS Commands.

Moving files has always involved the dreaded DOS commands. One wrong move — and who knows what can happen to valuable (yet seldom used) files. You don't want to throw them away, but you don't want them cluttering up your hard disk.

DiskVision allows you to SIMPLY move files by just tagging them — automatically the files are copied onto a floppy disk and a label is printed. Files are then (optionally) erased from the hard disk. Sort files by date and erase aged files automatically — even search for files and view them!

Create Labels, Reports and Catalogs for Your Diskettes.

Diskette Manager 4 is a state-of-the-art catalog/labeling system. New features include file-by-file comments, and the ability to use disk volume labels as disk names. Create, modify reports and labels with an innovative new report generator. Predesigned reports and labels are included. Catalogs hold up to 1000 diskettes or 32,000 diskette files.

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DiskVision **Just $69.95**

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Runs on IBM PC, XT, AT, PS/2 and compatibles. Requires 1MB.

The Individual Modules: *An In-Depth Look.*

► Hard Disk Manager

- Create an unlimited number of easy-to-access sub-menus.
- Help screens are available for each menu item, or quickly create your own custom help topics for your particular situation.
- Supports hard disk & floppy menuing.
- Provides easy access to files, then fast access back to the menu.
- Complete password and security protection.
- Also supports mouse menu operation.

► File Archive Manager

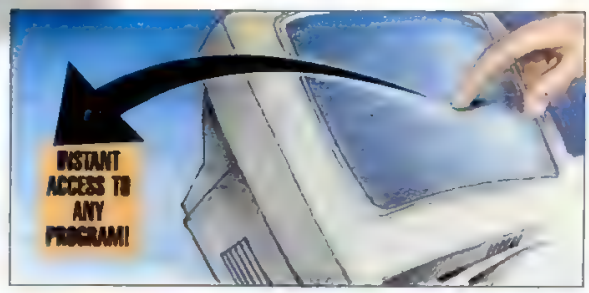
- Remarkably simple moving, copying and erasing of files.
- Simple, no-nonsense point-and-shoot file location and selection.
- To move, copy or erase files — just tag them!
- Quickly move files from anywhere to anywhere — hard disk or floppy.
- Transfer files without altering them whatsoever — assures complete recoverability at any time.
- DiskVision maintains a complete log of all file operations for accurate file tracking.

► Diskette Manager 4

- A special, enhanced version of our popular Diskette Manager 3
- Instant cataloging and labeling of any floppy.
- Print labels and catalog files in one step.
- New! File-by-file commenting for more accurate tracking.
- Allows complete diskette commenting.
- Supports virtually any label size or style.
- Quickly locate files using fast, easy searches through the catalog.
- Catalog 1,000 diskettes or 32,000 files.

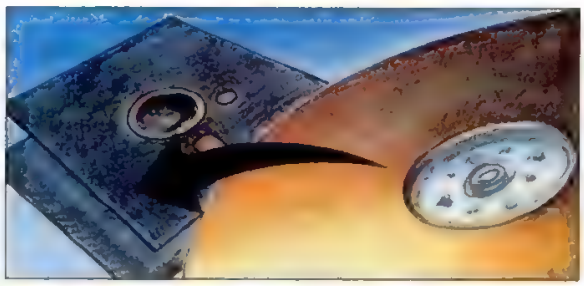
The Fastest, Easiest Menu. ►

Turn on your computer and start working! Programs and files are accessed instantly — no navigating through DOS commands. Features advanced security and allows an unlimited number of sub-menus. Supports hard disk as well as floppy menuing.



Streamlined New Archiver. ►

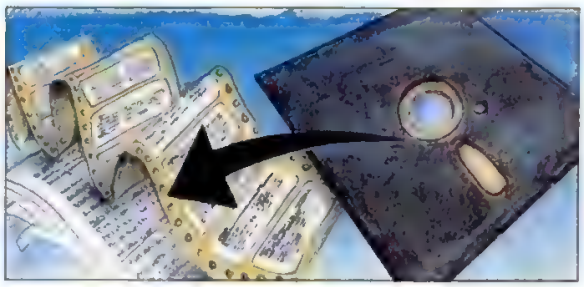
Clean up cluttered hard disks — just tag files on the menu screen — then instantly "move," "copy," or "erase" them. Move any files — from anywhere to anywhere — in seconds, with no DOS commands! Transfer and archive files without altering them — assuring total recoverability at any time.



INCLUDES NEW DISKETTE MANAGER 4!

Diskette Labeler/Cataloging. ►

Instantly create labels for your diskettes. Now includes "File By File" commenting. Automatically labels archived diskettes. Supports virtually any label size made. Easily locate files by fast, simple searches through the catalog. Catalog 1000 diskettes of 32,000 files!



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And FormTool will print forms sideways, make adjustment of line and character spacing — even print math symbols.

FormTool was designed to meet an urgent need of the business environment: *provide a low-cost means by which users can quickly and easily create their own forms using virtually any equipment — just sit down and create a form.*

Draw Lines, Boxes And Grids — In Seconds!

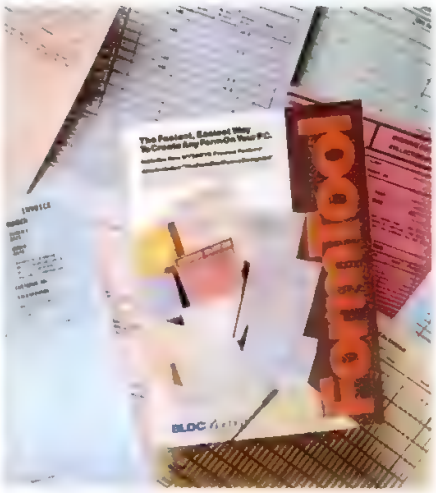
FormTool streamlines the PC's ability to draw — lines, boxes and grids are drawn with just a couple of keystrokes. You can change your grid layout, adjust type sizes, rearrange boxes — in seconds!

An advanced word processor handles word and character wrapping, custom "FastTabs," and the ability to automatically fit text into a defined area — or quickly reformat if necessary.

PC MAGAZINE

"...Its simple, clean design makes it quick to learn and use... We were able to draw our purchase order form in just 6 minutes. Lines and boxes are very easy to draw and erase."

—PC Magazine



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FormTool includes over 120 pre-designed forms ready to use — or modify them to fit your particular needs. Plus, a guide to forms design by forms expert Michael J. McCoy.

Includes Full-Page WYSIWYG Preview!

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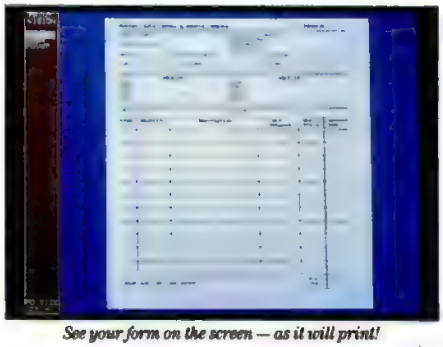

See your form on the screen — as it will print!

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FormTool **Just $79.00**

MW 1010 FormTool 3½" $79.00
MW 1020 FormTool 5¼" $79.00

IBM PC, PS/2, compatibles with 256K memory. Floppy or hard disk, supports all color or monochrome monitors with or without graphics card and virtually all dot matrix, daisywheel and laser printers.

Anatomy of a FormTool Form

Horizontal And Vertical Line Drawing. All you have to do is position the cursor where you want to draw a line. Then hit one key, and FormTool will automatically draw the line.

Any Type Style. Choose from italic, underlined, bold, bold italic, superscript, subscript and user defined styles.

Large Letters. You can select large letters, and even oversize letters up to one inch tall.

Line Width. [illegible] or bold lines, and FormTool will draw them. You can also switch between single, double and bold lines with one keystroke.

Form Fill-In & Merge. You can easily set this form up as a template for filling in — to be printed, or stored.

Automatic Grid Drawing. Drawing a grid is easy — just specify:

- Column width
- Row height
- Number of columns
- Number of rows

Or leave any out, and FormTool will automatically draw the grid based on your specifications.

Form Size. [illegible] custom size from postage stamp to 13½ inches. FormTool also [illegible]

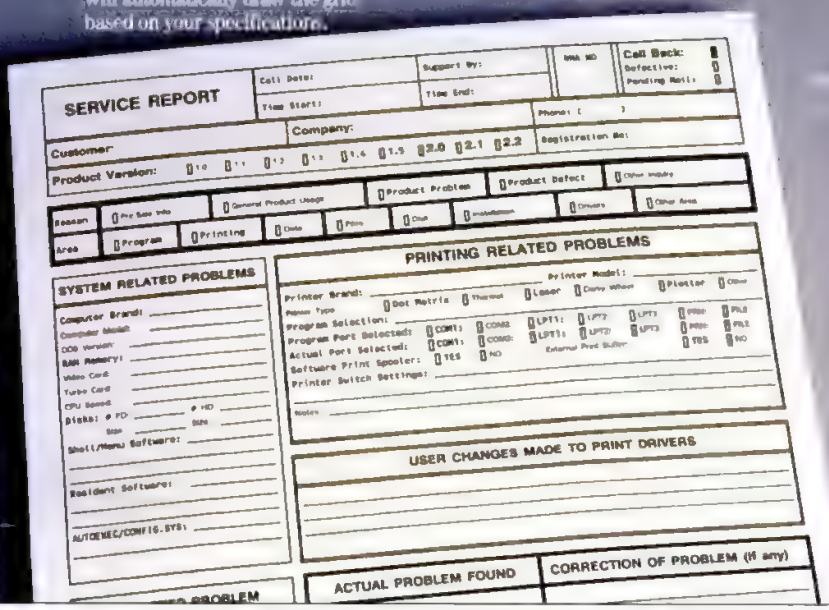
Speed Characters. [illegible]

Mix Single and Double Lines. [illegible]

Perfect Corners. [illegible]

Variable Text Views. [illegible]

Variable Spacing. [illegible]



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Power Tools for Your PC...

TigerSoftware presents The Complete PC line of professional quality hardware accessories that turns a spare room, a telephone and your computer into a powerful place of business. Add a fax (an indispensable item) to your PC — or your laptop. An internal answering machine can be quickly added to your PC for ultimate convenience and functionality.

Three types of super-sharp scanners (full-page, half-page and hand-held) allow you to easily include graphics and logos into your pages.

The Complete Page Scanner

The Complete Page Scanner can scan images up to 8.5"×14" at 200 or 300 dpi. View images on screen as you scan. Scale images from 10% to 200%; rotate, crop, erase, and pixel edit images. Your choice of three dithering patterns for scanning photographs. Then export images to the most popular word processing, graphics and desktop publishing programs. Save images in Dr. Halo, PC Paintbrush+, TIFF, GEM, MS Windows Paint, and CPC fax formats.

Prints out on laser or dot-matrix printers. Includes scanner, power cord, interface card, SmartScan™ software, user's guide and 90-day warranty. Optional OCR software.

The Complete Half-Page Scanner/400

Scan images up to 4"×14"at 200, 300, or 400 dpi with The Complete Half-Page Scanner/400. View images on-screen as you scan. Scale images from 10% to 200%; rotate, crop, erase, and pixel edit images. Your choice of three dithering patterns for scanning in photographs.

Scan An Entire 8½" × 11" Page In Just Two Quick Passes!

Sleek ergonomic design with large viewing window makes it easy to position the scanner accurately on the page. You can export images to the most popular word processing, graphics and desktop publishing programs, or save them in Dr. Halo, PC Paintbrush+, TIFF, GEM, MS Windows Paint, and CPC fax formats. Prints out on laser or dot-matrix printers. Includes scanner, interface card, SmartScan™ software, user's guide and 2-year warranty. Optional OCR software.

The Complete Hand Scanner/400

The Complete Hand Scanner/400 is the ideal personal scanner for desktop publishing. Compact, flexible, and easy to use, CHS/400 is perfect for adding photographs, drawings, logos, and signatures to your word processing and desktop-publishing documents. Scan images up to 2½"×14" at 200, 300, or 400 dots/inch. View the image on screen as you scan. Scale scanned images from 10% to 200% to fit your page. Rotate, crop, and edit your image or merge together multiple images to create a full page. You can export images to the most popular word processing, graphics and desktop publishing programs, or save them in graphics formats.

The Complete FAX/9600

Also Available In 4800 Baud Mode

Send and receive documents to and from any Group III fax machine. Delayed transmission lets you send unattended fax messages when phone rates are lowest. Broadcast feature sends fax messages to multiple locations with a single command. Automatic redial saves time when lines are busy. Operates in background without interrupting the program you're using. Uses just one phone line for both voice and fax transmission. Includes add-in card with 9,600 bps fax with on-board processor, operating software, user's guide, telephone cord, and 2-year warranty.

The Complete FAX/Portable

This external fax makes it easy and less expensive to fax from hotels, airports — anywhere you travel. It's lightweight and small enough to fit in a pocket! Plugs into serial port and runs on AC adaptor or 9V battery. Send and receives fax messages at 9,600 bps. Delayed transmission lets you send unattended fax messages. Broadcast feature sends fax messages to multiple locations with a single command. Includes plug-in fax unit, operating software, AC power adaptor, RS-232 cable, 25-pin adaptor, telephone cord, user's guide, and 2-year warranty.

The Complete Communicator

PC Computing's Most Valuable Product for 1989 delivers 9,600 bps Group III fax capabilities with advanced telephone answering and message management. The 2,400 bps Hayes-compatible modem can send and receive documents to and from any Group III fax machine even while your computer is running other applications. So versatile you can fax directly from your PC, send to multiple destinations at one time, and schedule transmissions to take advantage of lower phone rates.

Automatic redial saves time when lines are busy. Fax forwarding lets you retrieve faxes from another location using any touch-tone phone. Voice messaging records calls even when you're not there, with remote play-back from any touch-tone phone. Deliver your recorded voice messages to multiple locations automatically, any time of day or night. Even includes convenient ports for The Complete PC Scanners.

The Complete Communicator includes add-in card, operating software, BitCom modem software, user's guide, telephone cord, and 2-year warranty.

The Complete Answering Machine

Answers incoming calls even when you're not there. Digitally records incoming and outgoing messages on your hard disk for improved accuracy and quality. Call in from any touch-tone phone to listen to your messages, or to change your greeting or system configuration.

The Complete Answering Machine can automatically call you at any number to deliver messages. Supports up to 999 individual password-protected mailboxes — one for each of your employees, departments or customers. Each mailbox can have its own personal greeting. Automatically calls and delivers your message to a list of people any time of day or night — keeps dialing until all messages are received.

The Complete Answering Machine can share a phone line with The Complete FAX or The Complete FAX/9600. Operates in the background while your computer is running other programs. Includes add-in card, operating software, user's guide, telephone card and template, wallet-sized quick reference card, and 2-year warranty.

TheComplete PC

MW 1715	The Complete Answering Machine	$269.72
MW 1720	The Complete FAX/4800	$269.72
MW 1725	The Complete FAX/9600	$472.52
MW 1730	The Complete Communicator	$607.72
MW 1735	The Complete Hand Scanner/400	$168.32
MW 1740	The Complete Half-Page Scanner	$202.12
MW 1745	The Complete Full Page Scanner with *FREE The Complete FAX/4800!*	$778.70
MW 1750	The Complete Hand Scanner OCR Software	$207.09
MW 1755	The Complete Full Page Scanner OCR Software	$347.49
MW 1760	The Complete Half-Page Scanner MAC	$337.32
MW 1765	The Complete Full Page Scanner MAC with *FREE The Complete Full Page Scanner OCR Software and Omni Page (Save $1300)*	$750.35
MW 1770	The Complete Portable Fax	$356.79

Call for system requirements

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Perform Advanced DOS Tasks Without Using DOS!

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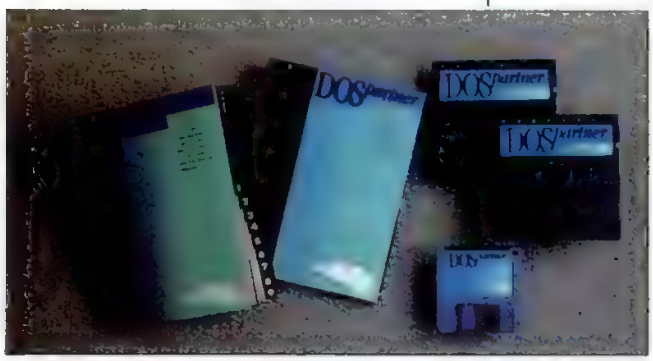
New DOS Partner Makes DOS Invisible!

Eventually, all computer users get caught up in The Productivity "Upward Spiral." They start out doing simple tasks with their computers. Maybe just working with word processing files, or simply keeping track of customers. Then they get a hard disk, and they want to start moving, merging, erasing and copying files. But to do so, they must take a walk down a road called "DOS."

"You Can't Get There From Here."

Suddenly, they feel lost and confused. A simple thing like copying a file can take scores of keystrokes, all that to remember, all that just to copy a file. So their productivity goes into a slump. But — it doesn't have to happen.

Now there's a simple, swift way to accomplish just about anything, without running head-on into DOS. New DOS Partner is a shell so sophisticated—anyone can use it to handle virtually any DOS function. And that includes organizing frequently used applications into one menu, copying moving or deleting directories, performing searches of the hard disk for files and applications, naming (and renaming) directories, disks and files.



Tested on the Toughest Proving Grounds.

"We use DOS Partner for our DOS functions because it allows us to perform routine, yet sometimes very advanced DOS functions faster than using DOS itself. But its true beauty is how it allows novice users to get things done." said Steve Pilchman, a TigerSoftware technician. "It's more than a menuing system, it's an inside track to DOS using very simple, straightforward terms. Whatever task you want done, it's virtually as easy as telling the system and pressing Enter."

Easy to Use.

- Eliminates the need to spend hours learning the DOS operating system and its command structure and gets you quickly to the work you have to do.
- Novice users will be able to install and begin using DOS Partner productively within an hour or less.
- Allows you to organize your most frequently used applications into one menu and start them easily.
- Permits you to move, copy, or delete an entire directory — including associated subdirectories and files — in one simple operation.
- Automatically searches your hard disk, finds applications, and teaches itself to run them.
- Renames directories, disks, and files.

► **Mouse Support.** Microsoft, Logitech, and compatible mice are now supported. Mouse movements move the cursor around, the left mouse button acts as an Escape; the right mouse button acts as an Enter.

► **File View.** Now, in three easy steps, the contents of a file can be displayed on the screen. You can page down, page up and move around within the file. Files cannot be altered — however, pressing the delete key will, after verifying, remove the file.

► **Drives Past D.** DOS Partner accesses drives E-Z.

EASYSOFT, INC.

DOS Partner **Just $69.95**

MW 8880 DOS Partner 5¼" & 3½" $69.95

IBM PC, XT, AT, PS/2 and compatibles with at least 512K RAM and DOS 2.0 or higher.

THE ANSWERS TO ONE OF DOS's MOST AGGRAVATING LIMITATIONS...

Give Your Files Fully Descriptive, 60-Character Names!

...Instead of Struggling with 8-Character Cryptograms. Also Includes Advanced File Management Capabilities...

SUPPORTS EMS

Seldom do we see software that adds such pure usefulness to everyday computing as Extend-A-Name Plus. The preposterous "eight-plus-three" DOS filename system has forced users to devise complex codes and cryptograms to remember file names. These crazy abbreviations always seem so easy to remember when you first think of them, but just try to find the file in six months — even in a subdirectory.

Extend-A-Name Plus is a RAM-resident program that allows you to give your files complete, descriptive, 60-character names (including spaces and a variety of special symbols).

Although there are programs available to help you find lost files, only Extend-A-Name Plus helps you *avoid misplacing it in the first place.* In addition, this very elegant system contains a host of fast, easy file management features that virtually eliminate the need for subdirectories and hard disk managers.

But Extend-A-Name Plus doesn't stop there. It allows you to find any file across a subdirectory by either the extended, or the DOS name. It's the only system that allows you to create subgroups within subdirectories. Unique "path trees" allow you to change directories by just "pointing-and-shooting." And Extend-A-Name Plus is faster and more capable than the document management facilities within Microsoft Word and WordPerfect.

Extend-A-Name Plus achieves its faster file access rate by keeping all long file names in a single file. By contrast, WordPerfect 5.1 must search each and every file in the subdirectory, one at a time.

What the Heck Is "F$1QTRRZ.WK1?"

Maybe it's "The first quarter results for the financial department." But you're not sure, it could be "Quarterly sales in all western territories." Extend-A-Name Plus lets you spell it out, plain and simple, so you can find it fast — even in six months. Using Extend-A-Name's convenient "File Window," you'll see a list of meaningful file names right on the screen like "Expansion plans for west coast offices — April statistics," or "Fiscal requirements for 1990 product announcements — 2nd rev."

Suddenly, finding your own files — as well as files anywhere across a network (Novell, 3COM, Banyan, Token Ring and others) — becomes amazingly simple.

Features of Extend-A-Name Plus:

- Full 60 character filenames
- Libraries — Categories within a subdirectory
- Path Trees — Easy access to any subdirectory
- Powerful File Finder — even across subdirectories
- Optional automatic DOS name numbering
- Tag & Get — document assembly
- Files can be sorted 12 different ways
- Fast Pop-up (up to 200% faster than WordPerfect 5.1)
- File viewer for WordPerfect & Lotus 1-2-3
- Provides all your file maintenance needs
- Can run in Expanded Memory (LIM 4.0)
- Works within 1-2-3, Quattro, PlanPerfect
- Full network compatibility
- Uses as little as 5K (with EMS)

"Overall, Extend-A-Name Plus ranks as one of the most useful DOS utilities on the market."
Paul Bonner, Senior Editor, PC Computing

Works Within Your Application.

Unlike other file managers that work only from a DOS prompt, Extend-A-Name Plus was designed to work from *within* your application. It's there whenever you need it. Extend-A-Name Plus supports WordPerfect, MS-Word, Multimate, Lotus 1-2-3, Symphony, Quattro (& Pro), PlanPerfect, Q&A, pfs: First Choice, pfs: Write, PC Write, Paradox, AutoCAD, and many others.

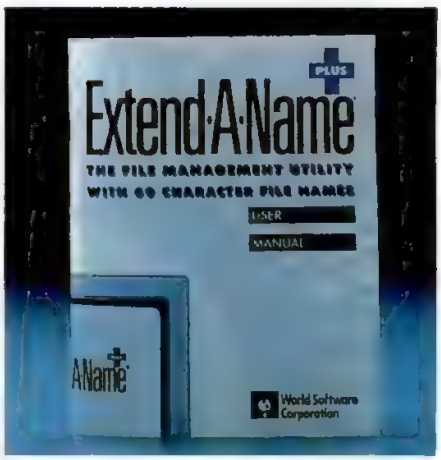
World Software Corporation

Extend-A-Name Plus **$69.95**

MW 1500 Extend-A-Name Plus 5¼" $69.95

MW 1505 Extend-A-Name Plus 3½" $69.95

For IBM PC/XT/PS2 and compatibles. MS-DOS 3.0 or higher. Compatible with EMM 4.0. Hard drive required.



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Add Style and Professionalism to Repetitive Printing Tasks.

NEW PRODUCT

Automate "Bulk-Printing" Tasks on HP and PostScript Lasers.

PageGarden is the latest project from computer visionary Dan Bricklin, creator of the original electronic spreadsheet and the popular prototyping packages Dan Bricklin's Demo Program and Demo II Program.

This time Dan innovates again with the first laser utility that creates custom formats for any repetitive or standardized print task. PageGarden gives you the ability to add dramatic graphic style to reports, lists, labels, name badges, envelopes, tickets and more without having to spend hours working on your desktop publisher.

And PageGarden delivers speed. An HP-LaserJet and PageGarden will blow the doors off the printer drivers included in leading word processors and desktop publishers.

PageGarden creates a format from your design — you simply add ASCII text from your database, spreadsheet, word processor — anywhere! Each time you print a dozen copies of a report, stacks of mailing labels or 300 name badges, they'll all have a custom, professional look. You can easily drop in logos or graphics stored in .PCX format (without going back to their native application), add gray areas, white-on-black type, sequential numbers, boxes with rounded corners, circles and more.

Produce Striking Listings and Reports.

Save time — and save paper — with condensed, easy to read printouts. Personalize reports with smart headers. Use the PageGarden "confidential" stamp. Print multiple files at the same time, each file in its own format.

Get Professional Output with Standard, Off-the-Shelf Laser Labels.

Personalize the return address part of your labels with any "pcx" bit-mapped graphic. Use the fonts built in your HP LaserJet or PostScript printer, or the Bitstream fonts included in this package. Position elements anywhere accurately... to 1/300th of an inch. Use PageGarden scripts for envelope printing too.

Special Features:

Sequential numbering (part numbers, ticket numbers, etc.), white-on-black letters (even on HP LaserJets), rounded corners, grey images and type.

Who's Using It?

All Laser printer users automate repetitive tasks with scripts that come with the package... and personalize scripts as described in the PageGarden tutorial. Companies standardize on the best laser printer formats. Others customize database output for perfect mailings and reports. Power users take advantage of advanced laser printer control with PDS (PageGarden Description Statement) language. Consultants create turnkey solutions for mailing labels, invoices, etc.

Dan Bricklin's is a registered trademark of Daniel S. Bricklin.
PageGarden is a trademark of Software Garden licensed to BLOC Publishing.

Create Custom Mailings!

Stop slapping labels on your letters when you mail them! Simply design a format — and print all of your envelopes in the same way. You can control the appearance of each and every piece of mail that your company sends out! You can even print special messages in large, bold lettering on your envelopes for important announcements.

"Spreadsheet" Publishing.

Dull spreadsheets are gone forever! With PageGarden, your spreadsheets can have a clear, professional look that adds drama and excitement to the presentation of your numbers.

The ability to add fonts, rules, borders, shaded areas, screens, graphics and logos can greatly enhance the impact of your spreadsheet.

Tickets, Badges, Coupons, Labels — Anything Numbered Sequentially.

PageGarden lets you mix a host of special effects into your smaller published pieces. Then, any number can be printed — each containing different information. Tickets, coupons, trade-show badges, identification labels — plus hundreds more uses! Sample templates enclosed.

Professional Formatting for Repeated Printing Tasks.

Using PageGarden, everything you print achieves a professional, consistent look. PageGarden makes sense for anything you print in bulk quantities — and helps it all look great.

Here's What You Get:

- Bitstream® fonts
- PostScript font for printing full IBM PC character sets
- Over three dozen page description scripts
- Transparent ruler for fine tuning output
- Tutorial to help you get started quickly
- Full reference for PDS (PageGarden Description Statement) Language
- Font decoder for descriptive listing of all HP LaserJet soft fonts
- 5¼" and 3½" diskettes.

BLOC Publishing

Dan Bricklin's PageGarden $99.95

MW 8060 PageGarden 5¼" & 3½" $99.95

IBM PC, PS/2, compatibles with 256K. Requires an HP LaserJet Plus, HP LaserJet series II, HP LaserJet IID, HP LaserJet IID, PostScript or 100% compatible laser printer. No special video adapter is required. Does not support DeskJet.

Highest rated utility for 1989 by InfoWorld Magazine

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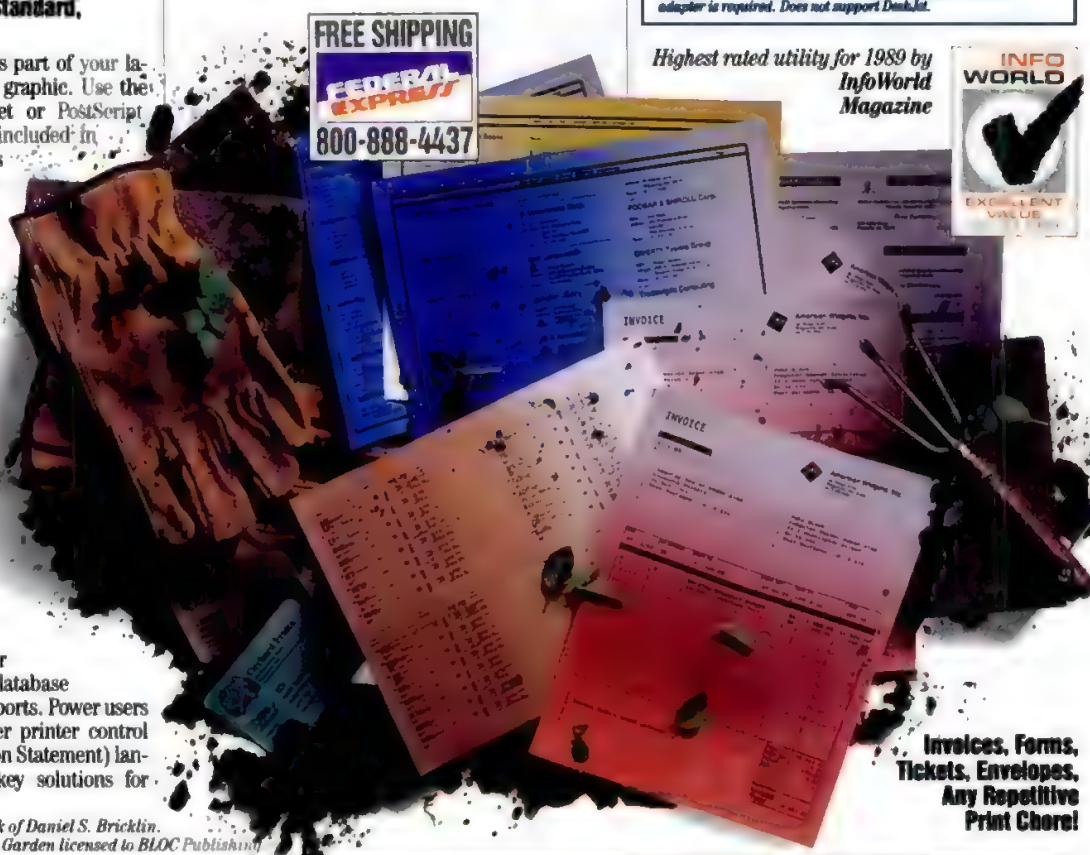

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For The First Time – Now PopDrop Can Load RAM-Resident Programs Into EXPANDED Memory!

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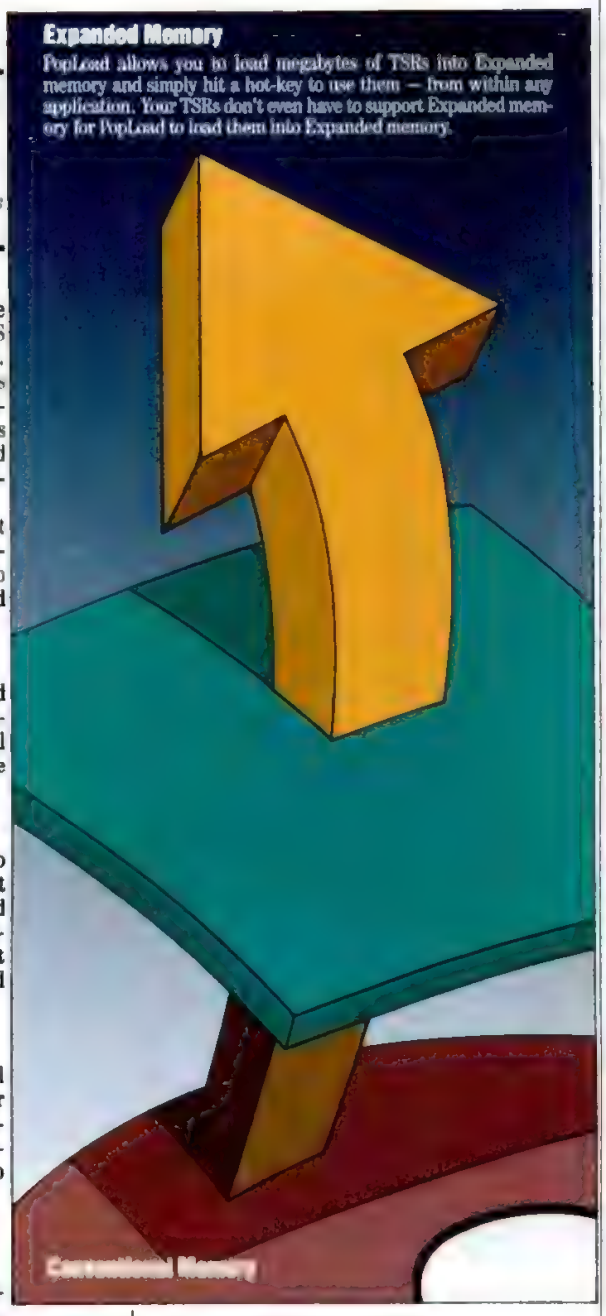
Introducing PopDropPLUS... A Breakthrough Concept!

► **PopDrop** for Managing RAM-resident programs in conventional memory.

► **PopDropPLUS** includes PopDrop *and* PopLoad — for loading RAM-resident programs into Expanded Memory.

(Pop Drop available separately for users without Expanded Memory)



Shatter the 640K Barrier.

Now, in one package, the software solution to the downside of DOS — its crippling memory limitations. PopDrop and PopDropPLUS give users the ability to manipulate RAM-resident programs in 640K RAM, as well as the ability to break 640K and load RAM-resident programs into Expanded Memory.

Not just another slow, inefficient "swapping" utility, PopDropPLUS allows your RAM-resident programs to run just as fast as they do when loaded into conventional memory.

The Memory Limits of DOS.

As software applications like word processors, databases and spreadsheets have become more powerful and productive, they have become more money-hungry as well.

The Solution.

PopLoad actually allows you to load up to 50 of your RAM-resident programs into Expanded Memory and execute them from within any application — even if the RAM-resident programs do not support Expanded memory!

Fatten Your RAM.

Your lower 640K of "conventional memory" is free to handle your larger applications without conflict or interference. With PopDrop and new PopDropPLUS, "RAM-resident" is no longer a dirty word.

Eliminate RAM-Resident Conflicts.

PopDropPLUS also includes a utility that allows you to remove, replace, deactivate and reactivate spell checkers, thesauri, keyboard macro programs, print spoolers, desktop organizers, notepads, calculators and more — without rebooting! PopDrop eliminates memory and keyboard conflicts that result from loading certain RAM-resident programs together.

PopDrop will support networks and won't interfere with any of your other programs.

PopDrop works by dividing your memory into layers — up to 16 — each of which may contain several programs. After loading DOS and your permanent programs, RAM-resident programs are loaded with these layers between them, the most permanent at the bottom, the least permanent at the top.

Create batch files to remove layers one at a time, several, or all of them at once.

And while other products gobble up to 40K, PopDrop needs just 1K!

Simple to Use — No Commands to Learn.

Use your TSR's normal hot-keys to activate and deactivate them from within expanded memory. No cryptic commands — and nothing to learn!

Efficient, Sensible Use of RAM.

PopDropPLUS uses memory efficiently and only on demand. EMA is not allocated for a RAM-resident program until it is activated. When that occurs, PopDropPLUS loads the RAM-resident program from its original location on the disk. By handling executable file address location itself, PopDropPLUS eliminates the need to create and save a memory image file. In addition, loading on demand avoids committing memory for RAM-resident programs which may not be used in the session.

PopDropPLUS vs. The Competition.

This is the only product that truly shatters the 640K barrier while still delivering instant control of RAM-resident programs...

The memory requirements for five popular TSRs (SideKick, SuperKey, Turbo Lightning, SETUP2 and XDIR) versus PopDropPLUS:

Task	PopDropPLUS	Competition
Conventional Memory Used	**27K**	93K
Expanded Memory used with 5 TSRs loaded	**344K**	508K
Disk space used for swap files for 5 TSRs	**0**	581K
Keyboard "slowdown"	**No**	Yes

Use of Features	PopDropPLUS	Competition
DOS commands to configure 10 TSRs	**1**	50
Number of TSRs per configuration list	**50**	32
Self removal supported	**YES**	No

BLOCPublishing

PopDrop & PopDropPLUS
Just $49.95 and $99.95

MW 2130 **PopDrop PC 5¼"** **$49.95**
MW 2140 **PopDrop 3½"** **$49.95**
MW 2150 **PopDropPLUS 5¼" & 3½"** **$99.95**

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Software to Quickly Create Authoritative Employee Handbooks.

Protect Your Employees — And Your Company!

Human resource and labor law experts agree that one of the most important documents your company will publish is the employee handbook.

A professionally-written policy handbook clearly defines an understanding on areas such as non-discrimination, employment termination, pay periods, smoking, medical leaves of absence, overtime, performance, and behavior.

How the System Works.

Personnel Policy Expert begins by focusing on the significant issues of over 60 policy topics. It asks key questions about your specific situation and actually writes an employee handbook tailored to your needs. The built-in word processor gives you complete control over each policy's final wording.

Easy to Learn and Use.

Although you'll want to give your employee handbook careful thought, actually *putting together* the handbook is just a matter of following the menus on the screen. You'll be well on your way just minutes after opening the box!

"Takes the pain out of creating employee handbooks... a time-saving, easy-to-use tool." —PC Magazine

"...can be used either by large corporations... or by small companies that need help in quickly producing a usable handbook." —PC Week

"For those of you who have to research and write policies, now there is a package that can ease the pain." —InfoWorld

Authoritative, Up-to-Date Information.

Includes human resources and labor law information on over 60 important policy subjects. The system offers explanations of each topic, the pros and cons, legal requirements and standard business practices. These discussions provide insight on the possible ramifications of policy decisions.

And Personnel Policy Expert is updated regularly to reflect changes in HR practices and federal regulations.

In Use at Major Corporations.

Personnel Policy Expert is in use in such corporations as *Canon Business Machines, Pioneer Communications, MCI Communications, The National Broadcasting Company, Coldwell Banker, Budget Rent-a-Car, Labatt Brewing Co., Dow Chemical, The New York City Criminal Justice Agency, and many more.*

The program goes far beyond inflexible model policy manuals that require you to do all the work. This expert system program educates you on the critical personnel and legal issues and then, based on your informed policy decisions, it writes the policies for you.

Fast and Easy-To-Use.

With Personnel Policy Expert, there are no complicated commands to memorize. You can begin to write policies immediately by simply following the menus on the screen.

For Use In All 50 States.

Personnel Policy Expert is designed to write policies for employers throughout the U.S. It will significantly reduce the time you must spend with your legal counsel ensuring that the policies are in compliance with all federal, state and local laws.

Six Easy Steps... From a Blank Page to a Completed Personnel Policy!

- ► **Policy Selection.** Select from over 60 policy subjects. Learn what employers should communicate to employees — and why.
- ► **Introduction.** General information acquaints you with the policy subject and the important issues to be considered.
- ► **More Information.** Practical human resource advice and labor law expertise are provided to help you answer the questions critical to each policy subject.
- ► **Questions.** Key questions are asked, allowing you to specify your policy preferences. Your answers directly tailor the policy to your organization's unique requirements.
- ► **Recommended Policy.** A professionally-written, easy-to-read policy (based on your answers and the knowledge of our experts) is created in seconds. A word processor is included for easy editing.
- ► **Print and Distribute.** Completed policies are ready to be printed and assembled into your new or revised employee handbook.

KNOWLEDGEPOINT

Personnel Policy Expert $495.95

MW 9000 **Personnel Policy Expert** 5¼ . . **$495.95**
MW 9005 **Personnel Policy Expert** 3½ . . **$495.95**
IBM PC, XT, AT, PS/2 and compatibles, 512K RAM.

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Issues Covered by Personnel Policy Expert

- Access to personnel files
- Administrative pay corrections
- AIDS in the workplace
- Attendance & punctuality
- Bereavement leave
- Child care benefits
- Conflicts of interest
- Dress code
- Drug & alcohol use
- Drug testing
- Educational leave
- Employee emergency closings
- Employee acknowledgement form
- Employee benefits
- Employee conduct & work rules
- Employee welcome message
- Employee reference checks
- Employee relations
- Employment applications
- Employment categories
- Employment termination
- Equal employment opportunity
- Family leave
- Hiring of relatives
- Holidays
- Immigration law compliance
- Introductory statement
- Jury Duty
- Maternity-related absences
- Medical leave
- Military leave
- Nature of employment
- Non-disclosure
- Organization description
- Outside employment
- Overtime
- Pay advances
- Pay deductions & setoffs
- Paydays
- Performance evaluation
- Personal leave
- Personal data changes
- Pre-employment physical exams
- Probationary period
- Relocation benefits
- Resignation
- Rest & meal periods
- Return of property
- Safety
- Security inspections
- Severance pay
- Sexual & other forms of impermissible harassment
- Sick leave
- Smoking
- Solicitation
- Time off to vote
- Timekeeping
- Title page
- Use of phone & mail systems
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- Vacation benefits
- Witness duty
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...and more as new policies are added!

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CIRCLE 515 ON READER SERVICE CARD

"Hello, I won't be coming to work on Monday! I just won the lottery!"

The Most Comprehensive Lottery Wheeling & Tracking Systems.

We've seen over 30 "Lottery" software packages in the last year, but only one truly provides an intelligent, professional approach to winning — and winning often. Specializing in the lucrative "Pick-Six" games, Lottery Tracker And Wheeler has actually proven to increase the odds of winning by several hundred times! A unique concept in "wheeling" numbers (playing various combinations of the same numbers) maximizes payoff possibilities on any "Pick-Six" from any state.

Lottery Tracker And Wheeler also has enough power to produce detailed trend charts, record and analyze past winning numbers, produce accurate statistics on frequency, recency, percentages and HOT or DUE numbers.

The Pick of the Experts.

Lottery experts agree that Lottery Tracker And Wheeler's sophisticated techniques are the most effective for Pick-Six.

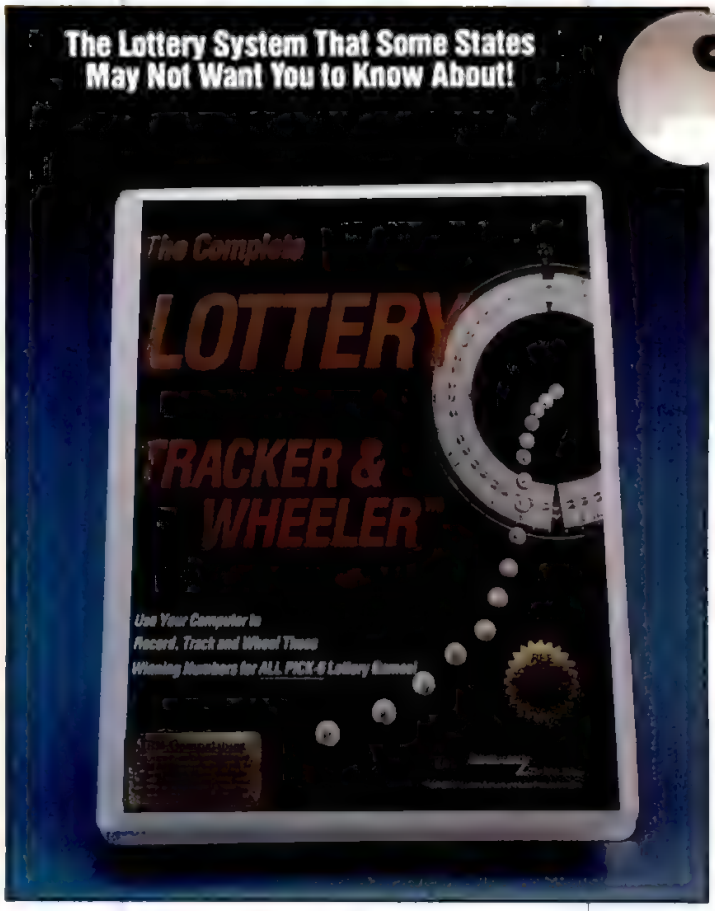
"We've been playing the Florida Lottery for three weeks using Lottery Tracker And Wheeler, and as a group have won over $1100.00! "

Letters keep pouring in from the happy Pick-Six winners that have used the all-new Lottery Tracker And Wheeler. They're turning winning the Lottery into a science.

Fun and Profitable!

This remarkable system makes playing Pick-6 games fun — and profitable! It can systematically increase your chances of winning by HUNDREDS of times. It includes twenty of the most popular wheeling systems of the world.

By using the power of your PC, you can actually track as many state and international lottery games as you like — there's no limit! As you collect information, you can produce expert "trend charts" to identify "hot" numbers that frequently win. You'll also pinpoint "due" numbers.



Lottery Tracker And Wheeler Features:

- **Record** hundreds of past winning lottery numbers and dates.
- **Track** as many state and international lottery games as you want — no limit!
- **Chart.** Produce expert trend charts to identify those HOT and DUE numbers!
- **Analyze** "hits" four ways: *bell curves*, to display overall tracks; *recency*, to identify numbers that hit within certain periods of time; *percentages*, offering probability tables for numbers; and *frequencies*, to indicate how often certain numbers hit.
- **Produce Statistics** for all numbers you play — no randomizing here!
- **Select Numbers** to play 5 different ways! You choose what YOU like best!
- **Check Your Bets** for *winning* combinations! Records *all* systems played including BONUS NUMBER, where applicable.
- **Print** charts, statistics, recorded numbers and wheeling systems!

BONUS!
Coupon for a FREE database of your state's past winning numbers!

In Use Around the World!

"The COMPLETE Lottery TRACKER and WHEELER" is sold in all 50 U.S. States and 23 foreign countries. You can be confident that you are using a tested and accepted tool for "handicapping" (TRACKING) and WHEELING lottery numbers.

Number Sequence Chart

The Number Sequence Chart is a new feature added to the Tracker and Wheeler program. You can select to include or not include Bonus Numbers (if applicable) and an information box prints at the end of each chart to help you read the information contained. This chart gives a graphic display of the sequence appearance of officially drawn numbers.

Number Occurrence Chart

The Number Occurrence Chart allows you to analyze 50 number groupings of past officially drawn numbers. Like the other new charts added, an information box is included and you can select for analysis of Bonus Numbers (if applicable).

Roll Your Own Ticket Selection

This new program feature allows you to produce straight (non-wheeled) ticket selections of Hot, Due and Random numbers in your choice of groupings.

Check for Winners (Data Base Search)

The new Check for Winners addition to the Tracker and Wheeler program is particularly useful as another analysis tool, or, simply, to review your data base for past winning numbers against tickets you have purchased, but have not checked. You may select from 3 to 18 numbers for your search as well as the number of drawings to go back in your lottery data base. An interesting use of this feature is to run the numbers you have selected to wheel against the past lottery winning data base to see how the numbers selected would have done, or, to test groups of actual ticket numbers in your wheeling choice through the Check Your Bets selection.

You Are the Best Judge!

We have provided the additional analysis tools to make it easier for YOU to analyze the past winning numbers, and from that analysis, select the best numbers to play. While it is true that we have letters on file from customers who have won cash prizes by selecting the HOT, DUE or EOL Combination numbers, it is important that you become familiar with the trends which develop from the machines and balls used in the lottery game you follow. We highly recommend that you choose the Select Your Own numbers when using the Place Your Bets menu to wheel various combinations. This has always worked best for us. Becoming familiar with the number selection trends in the game you play is an Art. Your own personal insight is very important.

Use the charts produced by this program to get an overall "feel" for the trends of the past officially drawn numbers. *Look* at the skip frequency to see if a number has a propensity to appear in the next drawing you will play. *Compare* the numbers to be played against the Spot, Sequence and Occurrence charts for trend factors. *Match* your selections against the Repeating Sets Chart with an eye toward natural grouping of pairs and triples. *Use the other available tools*, such as the Last 10 column on the Statistics Hit Chart and the Spot Trend Chart to find a statistical significance toward the individual numbers you select. *Get to know the lottery you play* by calling or writing the lottery commission for that game. We have been told, for instance, that California uses different sets of balls and number selection machines for each lottery.

"I hit 54 CASH PRIZES *the first 8 weeks with the help of your program! The Tracker and Wheeler* IS *the* BEST *lottery software program I have used overall... Over $2100.00 ahead after ALL expenses!*
— B.C., El Paso, Texas

"This system has helped me organize my bets — and it's paid off! I've won $8700 since I started. My hat's off to you..."
—P.F. Landry, Seattle, Washington

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The Complete Lottery Systems
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MW 6205 Lottery Tracker & Wheeler 3½" ... $39.95
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THE POWERFUL, VERSATILE LIBRARY MANAGER FOR YOUR DISKETTES. TigerSoftware ► (800) 888-4437

Organize, Create Custom Labels, And Produce Reports for Your Entire Library of Diskettes!

Custom Labels and Reports for 3½" & 5¼" Diskettes.

DISKETTE MANAGER 3 helps you print labels (both 5¼ inch and 3½ inch) and generate library reports for everything on your diskettes. Just read your diskettes into the system; each diskette directory (including subdirectories) is instantly cataloged, you can then print labels and reports showing the contents of each diskette — or your entire library.

DISKETTE MANAGER 3 will accept all diskette types and sizes recognized by DOS including 5¼ or 3½ inch, fixed disks, tape backups, 360K, 720K, 1.2 Mb, 1.44 Mb, etc. Catalogs of your files can be created to contain up to 500 diskettes and 32,000 files. You can choose from several predesigned label formats for your diskettes, or design your own.

Printer Support.

All printers are fully supported. All printer codes, font types and sizes may be used for printing labels. Serial printers supported through DOS MODE command.

Catalog Capacity.

Each catalog may contain up to 500 diskettes and 32,000 files. An unlimited number of catalogs can be created. Catalog size limited only by disk space. Diskette Manager 3 will print any label that your printer will accept. The diskette title will hold up to 20 characters (upper and lower case). The date and sequential serial numbers may be automatically added.

File names can occupy up to 66 lines on a 4"×1½" label, and unlimited file names using additional labels. Comments can occupy up to eight 57-character lines.

To find one particular file that's buried somewhere in that stack of fifty — or 500 — diskettes, quickly perform a catalog search to your specifications.

Menu-Drive for Fast, Easy Operation.

Diskette Manager 3's menu-driven system makes it easy to quickly create labels and reports to any specifications. Function-related help screens are available with one keystroke.

FREE LABELS! 20 5¼" & 20 3½" blank labels.

BLOCPublishing

Diskette Manager 3 Just $39.95

MW 2220 Diskette Manager 3
5¼" & 3½" $39.95

IBM PC, XT, AT, PS/2 or compatibles, 256K RAM, 2 floppy drives or one floppy drive and a hard drive, or any laptop (3½). Works with any parallel or serial printer. Number of files listed on a label is a function of the character size available on your printer.

CREATE CLEAN, PROFESSIONAL LOOKING ORGANIZATIONAL CHARTS - OR ANY TYPE OF CHART!

Organizational Charts, Procedure Diagrams, Decision Trees and More!

The Organizational Chart — A Valuable Management Tool...

How Do You Describe Your Company to New Employees or Prospective Clients?

Chances are, you devote pages of text in personnel manuals and sales presentations to management levels and work flow. Since a picture is worth a thousand words, the organizational chart is an ideal method of depicting a hierarchy, procedure or method — but charts involve making a layout, setting type, inking boxes — and revisions are murder!

Fast Charts for Any Purpose!

Now you can create charts in a matter of minutes — illustrate policy making, responsibility delegation, authority levels, flow charts, procedure diagrams, 'decision trees' — or for use in sales presentations.

Simplicity Equals Speed.

We completed our first chart in 11 minutes after opening the box! Sleek, easy-to-use box drawing capabilities make Corporate Ladder simple — just type your text and one keystroke draws a box around it!

Group boxes with another keystroke and revise charts in seconds. Change paper — and Corporate Ladder adjusts the chart size automatically! It even has an on-screen WYSIWYG display!

Use Charts to Increase Productivity.

Create popular "Decision Tree" charts that lead employees and associates through "if-then" decision-making choices. This type of chart is designed to reduce administrative time and increase individual productivity.

The "Procedure Diagram" illustrates sequential steps to follow when undertaking a certain task.

Unique "Finishing Touches" Feature.

Once you've completed the layout of the chart, Corporate Ladder will automatically center text, center lines and align boxes. It even consistently spaces the elements of the chart.

If you need to make revisions, simply insert your new boxes or text, hit the "Finishing Touch" command, and the chart is realigned and perfectly spaced. That's the beauty of Corporate Ladder — the ability to actually see what your chart will look like as you work.

Supports most dot-matrix and laser printers! Even supports plotters!

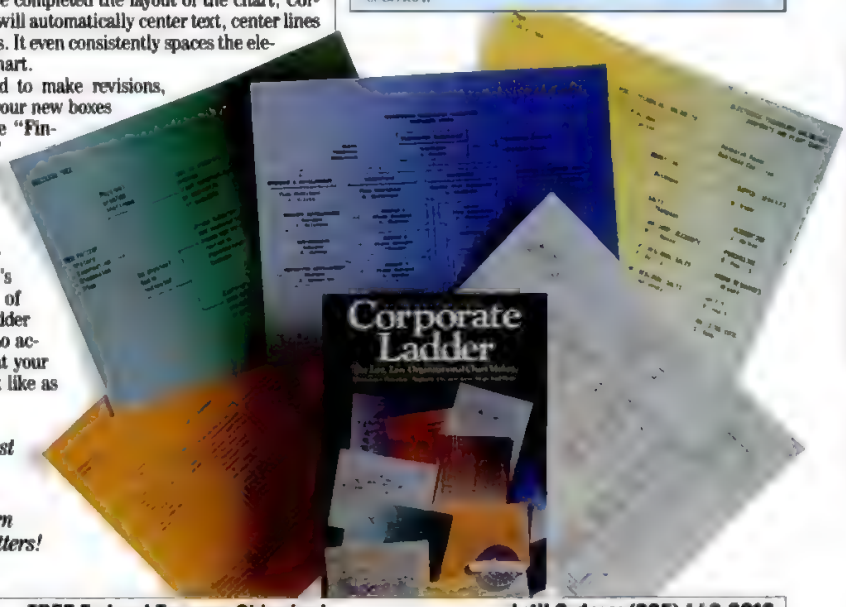
FREE FONTS! The Laser Font-Pack includes two additional typefaces (Courier and Modern Letter Gothic) and allows four additional sizes ranging from tiny (25 cpi) to oversize (8 cpi). All fonts supplied in normal and sideways formats. *A $29.00 value.*

BLOCPublishing

Corporate Ladder Just $79.95

MW 4950 Corporate Ladder 5¼" & 3½" . $79.95

IBM PC, XT, AT, PS/2 and compatibles with 512K RAM. Supports virtually any dot matrix printer — including the HP Laser-Jet Plus or Series II



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CIRCLE 515 ON READER SERVICE CARD

The Award-Winning Hard Disk Management Environment.

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An Innovative & Comprehensive Set of Disk-Management Features.

Introducing the concept of "intuitive" disk management, XTreePro Gold's unique approach allows you to do more with less effort. You'll fly through complex tasks like searching through files by contents; opening files along with their applications; copying or moving blocks of text between files; even viewing files in the native formats of applications like dBASE, Lotus 1-2-3, Microsoft Word, WordPerfect and many more.

A leader in disk management for years, XTreePro redefined the concept — XTreePro Gold has swept the industry — becoming the corporate standard.

XTreePro Gold's power is simple to unleash; any operation can be quickly completed with just a mouse click or keystroke. No cryptic commands, or lengthy path names to remember. If you care about your hard disk, let XTreePro Gold bring a new level of competence and sophistication to your computing.

Autoview: XTreePro Gold's powerful Autoview feature allows users to view multiple files across multiple directories, automatically, *in a single operation.*

Open Sesame

With XTreePro Gold's Open File feature, you can locate any data file that you need and launch the application that created it without ever leaving XTreePro Gold! At the tap of a single key, or a click of a mouse, your files in WordStar, MultiMate, Lotus 1-2-3, WordPerfect, Paradox, PageMaker, Harvard Graphics and any other program open up at your command. You save time and keystrokes because XTreePro Gold eliminates the multiple steps normally required to first open a program, wait for it to load, and then open a data file.

Cut & Paste

Gather is another exclusive and very powerful new feature of XTreePro Gold. With Gather, you can copy or move a block of text from one file *directly* into another file or straight to your printer, quickly, easily and safely using a few keystrokes or a couple of clicks of your mouse.

Point-and-Shoot Application Menu

With XTreePro Gold you can blast into software programs like dBASE IV or WordPerfect simply by pointing to them on the application menu. You can customize each menu item by creating up to 16 lines of batch-like DOS commands, so that you reduce elaborate keystroke procedures into a single, simple step.

For example, to get into Microsoft Word from the "C" prompt (C:>), normally you would type "CD\WORD" <Return>, "WORD" <Return>, then wait for Microsoft Word to load. Using XTreePro Gold's application menu, this same process is reduced to two keystrokes or a double click of your mouse, and *voila!*

You can also use the application menu to create customized interfaces for others to use (and even configure the menu so they can't edit or delete your work!).

Finally, you can collapse XTreePro Gold to a scant 7K or memory just before launching into any application, or opening a data file, or running your text editor. So while XTreePro Gold is always ready and waiting for your next command, it won't waste precious RAM when you're not using it.

More Room with a View

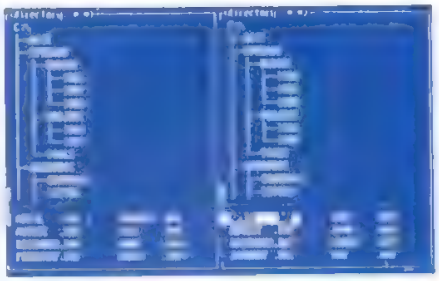
Like the award-winning XTree and XTreePro, XTreePro Gold can view and display file contents in ASCII and hexadecimal formats. However, XTreePro Gold advances this concept to allow you to see formatted views of the contents of files in Lotus 1-2-3, dBASE, Microsoft Word, WordPerfect, MultiMate and most of the other programs you use every day!

Using XTreePro Gold's powerful AutoView feature, you can also view the contents of your files from the file directory. For example, let's say you're looking for a memo in a directory marked MAYMEMOS and you're not sure which one it is (the 8-digit file name limitation in DOS can get confusing sometimes). AutoView splits the screen and allows you to browse through the files on the left, while displaying their contents on the right.

XTreePro Gold Does Split Windows

Okay. Say you have two different disks or two different directories each loaded with information and you need to compare each disk and directory independently and work in a variety of files. No problem! A function key splits your current screen display into side-by-side, independent work areas, so you can easily view, compare, and manipulate files any which way you want. Just TAB to move between the independent windows.

With split windows, you can compare file directories and quickly locate files. You can also view (or preview or review!) the directory trees on different disks in separate drives, or compare one disk against another. No more shuffling floppies back and forth. No need to buy another drive. No more guesswork. Just power and flexibility. When you want it, and how you need it.



Split Screen: One keystroke or mouse-click splits XTreePro Gold's current screen display into side-by-side, independent work areas, so users can easily view, compare, and manipulate files any way they want.

Prune & Graft

No, this is not a law firm, but rather a nifty new feature that lets you quickly move (or graft) an entire branch of a directory tree (including all sub-directories) to a different location on your directory tree in a single operation! Just press a key or click a mouse and stand back!

Prune allows you to quickly delete an entire branch (and all sub-directories) from your directory tree. Because prune is such a powerful feature, XTreePro Gold double checks your action before files are deleted.

Both prune and graft are amazing tools for reorganizing your files and removing unwanted or old files from your hard disk.

Keystroke History Repeats Itself

Saving time, keystrokes and making the time you spend with your computer more productive is what XTreePro Gold is all about. So it should be no surprise that the program maintains a history of your command responses so you can quickly recall, modify or re-use them at any time. Your last 12 responses for each XTreePro Gold command prompt are saved in the order you used them. So if you copied or moved a file earlier, when you're ready to repeat that performance, all you nave to do is use your arrow keys or mouse to scan through your old keystrokes until you find the ones you need.

Mighty Mouse Support

One of the biggest enhancements in XTreePro Gold is our mighty mouse support. Using the mouse, you can now glide through every XTreePro Gold operation by simply pointing-and-clicking! Scroll through file directories and file windows, tag and untag files, point to commands and key prompts in the Command Menu areas, click on key fields during Command Dialog, and open any program from within XTreePro Gold's Application Menu.

Format Floppies on the Fly

Remember how frustrating it was to start copying files from your hard disk to floppy disks only to discover mid-way through the operation that you forgot to format one of those disks? Well, XTreePro Gold lets you format all standard diskette types: 360K, 720K, 1.2M, 1.4M *at any time,* even in the middle of copying files, without interrupting the operation at hand or destroying the work you've already done!

XTreePro Gold vs. The Competition.

	XTreePro Gold	Nort. Cmdr. 3.0	Lotus Magellan	PC Tools
Applications menu	•	•	macro	•
Auto view	•		•	
Find files	•		•	•
Copy/move file contents	•		•	
View files	•	•	•	•
Open/associate appl.	•	•	•	•
Split windows	•	•		•
Prune/graft	•		•	•
Global file views	•			
Collapse directories	•			
Hide/unhide:				
Directories	•			
Format disks	•			•
Wipe disks	•			
Toggle tagged files	•			
Merge tagged files	•			
Reverse file specs	•			
Copy orig. directory:				
Structure	•		•	
Date/time stamp files	•			
Print directory tree	•			
Change file attributes	•	•		•
Rename a volume	•			•
Archive Manager	•			
Suggested Retail Price	$129	$149	$195	$129

XTREE COMPANY

XTreePro Gold — Just $99.00

MW 8020 XTreePro Gold 5¼" $99.00
MW 8025 XTreePro Gold 3½" $99.00

IBM PC, XT, AT, PS/2, compatibles; DOS 3.1 or higher; 256K RAM. Not network compatible.

The Premier Grammar, Style and Punctuation Checker for the PC!

RightWriter Helps You Produce Clear, Powerful Writing.

Remember the last time you read someone else's badly written letter?

How did it reflect on him? Now ask yourself a more important question. How does your own writing reflect on you?

Successful people communicate clearly... and powerfully. RIGHTWRITER is an intelligent system that flags common errors in your writing and helps you produce clean, crisp letters and proposals — applying 4,500 rules of grammar, style, usage and punctuation to letters, reports, proposals, press releases and more!

Works With Just a One-Word Command!

RightWriter is the most accurate system for business and technical writing. RightWriter analyzes documents produced by leading word processors for errors in grammar, style, usage, and punctuation. Using more than 4,500 rules, RightWriter helps make your writing clear, concise and powerful.

Just create your documents as you normally would, then, with a one-word command, RightWriter will check your document and display errors and comments. RightWriter never changes your writing... it only makes recommendations.

A Business Productivity Tool.

RightWriter can pay for itself with a single, well-written sales letter, proposal, report, or manual. Strong, clear writing can make the difference between making or losing a sale. Good writing is good business. RightWriter is also an ideal teaching tool. As it helps you improve a document, RightWriter also trains you in the principles of proper English.

Version 3.1 Features

- *It's easier to use, because it has only one command. Your word processor does the rest.*
- *Inserts messages directly into the text to point out problem areas in letters, proposals, reports.*
- *Now runs from within WordPerfect 5.0 & 5.1!*
- *Indexes measure strength of delivery, readability, use of adverbs, adjectives, jargon.*
- *Uses more then 4,500 rules to make recommendations.*
- *New Menu System allows you to customize RightWriter to meet your particular needs.*

Now Runs From Within WordPerfect 5.0 & 5.1!

This feature makes RightWriter 3.1 the perfect add-in for WordPerfect users.

Specific Recommendations *RightWriter flags common writing errors such as passive voice, noun-verb agreement and more.*

Readability And Strength Index *The Readability Index shows the educational level a reader requires to understand your writing.*

Parts of Speech, Sentence Structure *Other indexes measure your adjective and adverb usage, and use of jargon. Recommendations guide you in how to improve your sentence structure.*

Words to Review *The Words In Review list points out problem words that could cause confusion.*

RightWriter vs. The Competition.

Dr. Cynthia L. Selfe, Associate Professor of the Humanities Department at Michigan Technological University independently tested the big three grammar and style checkers. The results? — RightWriter wins hands down!

Researchers at Michigan Technological University tested the three IBM PC-based grammar and style checkers. The following is an excerpt from the letter which accompanied their findings...

"We've finished our independent tests comparing the performance, accuracy and usefulness of RightWriter 3.1, Grammatik IV and Perfect Grammar on two separate documents. RightWriter impressed us as far as style-analysis programs go: RightWriter correctly flagged 176 errors (with a total error rate of only 8%) in an essay that saw more than 20 major revisions

RightWriter has such a low error rate that the program rewards users instead of overwhelming them. RightWriter's manual was also both easier to read and more informative than either Grammatik's or Perfect Grammar's. RightWriter's problem explanations form a good refresher course in grammar and style

We believe RightWriter would be of value to writers interested in improving the surface structure of their writing. We applaud RightSoft's attempts to test their products thoroughly and in realistic situations

Sincerely, Dr. Cynthia L. Selfe."

Associate Professor, Humanities Department
Michigan Technological University, Houghton, Michigan

Which Grammar Checker Would You Trust?

Results for Test Document 1	RightWriter 3.1	Grammatik IV
Total Flags*	4124	1290
Correct Flags*	4085	1118
Incorrect Flags**	50	172
Error Rate	1%	13%

Results for Test Document 2	RightWriter 3.1	Grammatik IV
Total Flags*	201	182
Correct Flags*	174	118
Incorrect Flags**	27	64
Error Rate	13%	35%

**A higher value is better. **A lower value is better.*

TEST NOTES: *Flags were identified as "incorrect" if the program suggested textual changes where none were required or each time a program flagged a compound adjective as possibly mispunctuated when the word was punctuated correctly.*

RIGHTSOFT®

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MW 2860 RightWriter 5¼ & 3½ (Dual) $89.95
MW 2870 XENIX/UNIX $295.00

Runs on IBM PC, XT, AT and compatibles with 384K. Hard disk or floppy. Call RightSoft at (800) 962-0244 for upgrades and support.

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Enable®
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IBM Writing Asst.®
Leading Edge®
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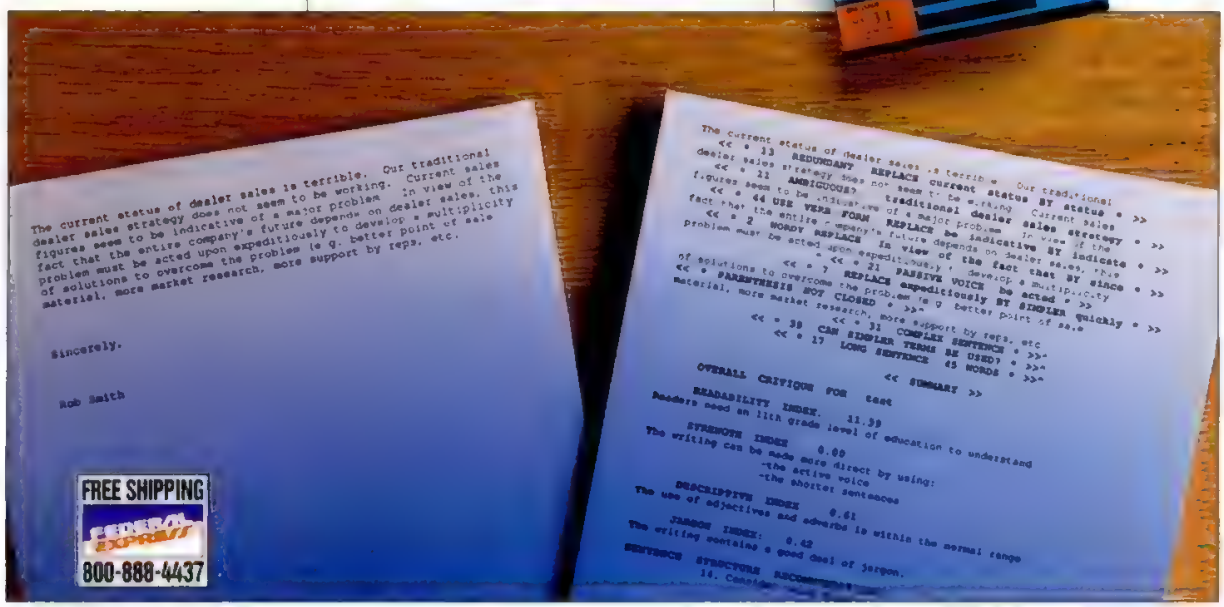
Microsoft® Works
Microsoft® Write
Multimate Adv.®
Multimate®
New Word®
OfficeWriter®
PC-Writer®
PeachText®
p/f: Write®
p/f: Prof. Write®
p/f: First Choice®
Q&A Write®
Samna®
SideKick®
WordPerfect®
WordStar®
WordStar 2000®
VolksWriter®
XyWrite®
All Standard ASCII Editors



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The Personal Weather Forecaster... Instant, Up-To-The-Minute Meteorological Information.

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Connect to the Same Weather Database Used by Radio & TV!

Should you plan the company outing for this Saturday? Wondering about the forecast for a business or vacation destination? With WeatherBrief, your PC becomes a personal meteorological center, allowing access to the WeatherBank information service. Via modem, you'll receive up-to-the-minute forecasts for any region or the country or the world — in just a few seconds! In fact, this is the same service used by radio and television stations. The maps that appear on your screen are the very same images downloaded to television control rooms and broadcast on the air. Weather professionals depend on the precise, timely meteorological information provided by WeatherBank — now you can, too.

Dazzling Maps.

The detailed, color-enhanced maps display current precipitation, temperature, cloud cover, storms, lightning, hurricane tracks, jet stream movement, freezing levels, soil temperatures and radar-gathered information. The fast, menu-driven operation provides information for family use, business travelers, travel agents, pilots and others. Quickly switch between maps for a complete picture of the current weather conditions anywhere.

As Much Detail As You Want!

What's the weather like in Paris, Tokyo, Rome, Sydney, Moscow, Frankfurt or Madrid? A menu selection displays complete information in seconds. Need highway reports, marine or aviation conditions? WeatherBrief provides fast, accurate forecasts including freezing levels and off-shore data. WeatherBrief also includes agricultural outlooks and extensive climate statistics (such as rainfall, average temperatures, etc.) for any region.

A Great Family Software Package!

WeatherBrief educates as it informs. By having access to weather information at any time, tracking patterns illustrate how weather actually works and how different regions compare and contrast. Watch hurricanes develop and progress with minute-by-minute updates. WeatherBrief is a great new use for the PC — and a practical tool for anyone who "can't change the weather, but needs to plan for it."

This Practical Peripherals Modem FREE with WeatherBrief

Includes 5-year warranty!

THE SOFTWARE TOOLWORKS

WeatherBrief **Just $99.95**

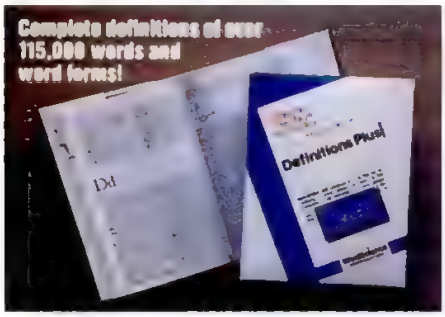
MW 1009 **WeatherBrief** 5¼" & 3½" $99.95

IBM PC, XT, AT. Requires modem.

Instant Word & Phrase Definitions, Hyphenation, Usage, & Synonyms to Enrich Your Writing.

Definitions Plus! – 795 Pages of Electronic Dictionary Information!

Sure, your word processor's spell checker helps you eliminate misspellings and typos, but that's as far as it goes. You still need to stop working and haul out the dictionary for definitions of certain words and to examine the sometimes subtle differences between synonyms that you might want to use. Need details on common (and not so common) phrases like "a la carte" or "sweat shirt"? — Only Definitions Plus! can provide them.



The fact is, spell checkers and thesauri don't help you write better. Only Definitions Plus! allows you to improve your writing by giving you instantaneous access to ***The American Heritage Dictionary*** — with complete definitions of over 115,000 words and word forms. In addition, Definitions Plus! provides hyphenation, grammatical classification (noun, verb, adjective, etc.), alternate forms and examples of proper usage for each entry. This RAM-resident program performs all functions using just three hot-keys. Look up the word the cursor is on, or type in a word or phrase you want information about — from within your word processor (or Lotus 1-2-3) — even from within your word processor's spell checker or thesaurus!

What happens when you want a complete definition for a word that you won't know how to correctly spell, or you enter a past tense or adverbial form? Definitions Plus!'s advanced intuitive capabilities will provide "guesses" for the word you need and display a list.

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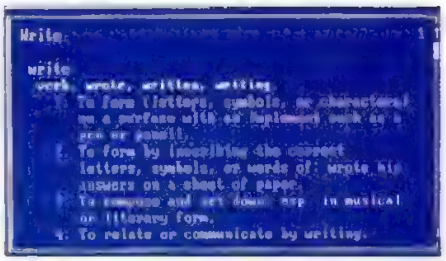

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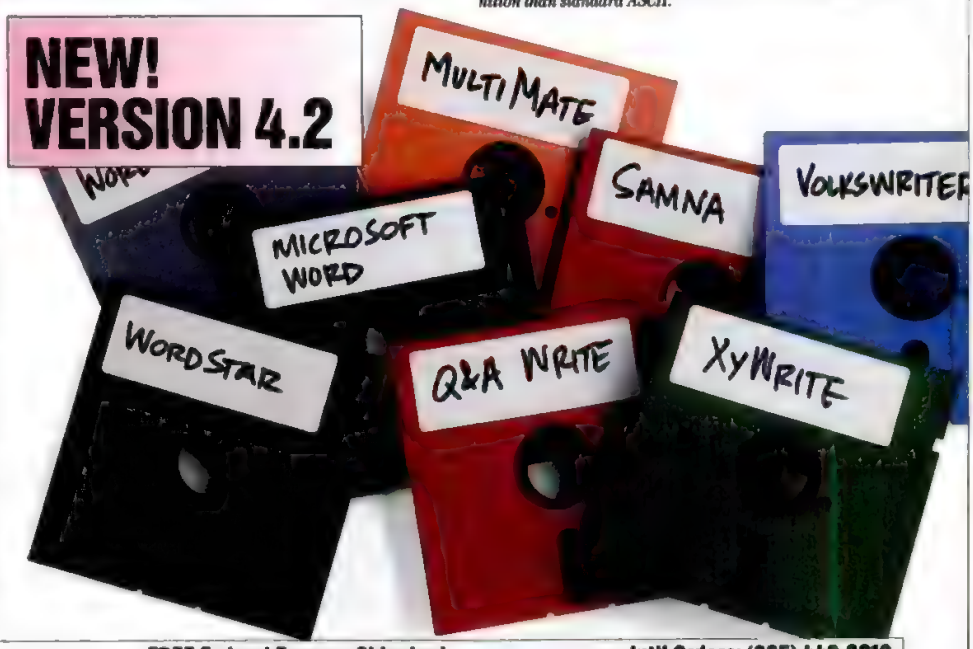

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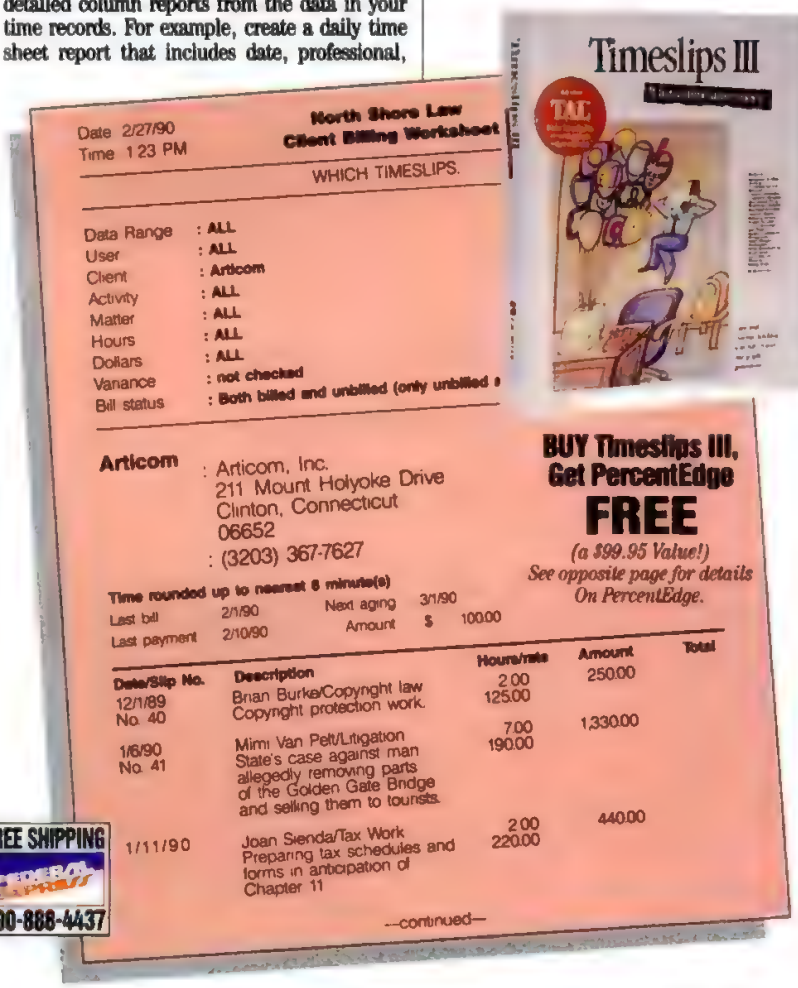

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A $1,000 Laser for Every Desktop

Last summer, HP's IIP turned the $1,000 laser into reality. Now, eight competitors offer lasers at roughly the same price. But HP is fighting back with its LaserJet III, with a street price as low as $1,500.

BY JOHN DICKINSON

Last summer, the dream of the $1,000 laser printer finally came true when Hewlett-Packard introduced its LaserJet IIP with a list price of $1,495. Not only was the IIP affordable, it also offered Series II–quality output and a selection of fonts that could be printed in landscape as well as portrait mode. The IIP was so good it won an Editor's Choice in our annual printer issue (see "Laser Printers: A Broader Spectrum," November 14, 1989).

Now, seven months later, the IIP has a lot of competition. The good news for the buyer is that there are a lot of choices and a lot of low prices: for this roundup we found nine 4- to 6-page-per-minute laser printers with list prices under $1,700 that promise street prices around $1,000. And, even as we were going to press, more low-priced lasers came out:

PHOTOGRAPHY: THOM O'CONNOR

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IBM's $1,495 5-ppm LaserPrinter E arrived just in time for preliminary testing (see the sidebar "Hot Off the Assembly Line: IBM's Auspicious Answer to the Low-End Laser"), but Panasonic's $1,695 8-ppm KX-P4420 Laser Partner wasn't shipping yet.

All this competition has led to significant price cuts. All the 4- to 6-ppm printers that were already on the market last summer—such as the Epson EPL-6000, the Facit P6060, the Fujitsu RX7100, and the Qume CrystalPrint Series II—now list for a lot less. Some of the prices fell as recently as December (just in time to make it into this article with our $1,700 cutoff). Lastly, Okidata, which planned to introduce its 4-ppm OkiLaser 400 at around $1,700, settled on a final price of $1,395.

These price cuts all occurred *before* HP's most recent introduction. With a list price of $2,395, the scalable-font, resolution-enhanced LaserJet III could sell for around $1,500—only $500 higher than the IIP (see the sidebar "HP LaserJet III: The Low-End Laser to Beat"). Faced with a choice between a $1,000 4- to 6-ppm Hewlett-Packard clone and a $1,500 8-ppm state-of-the-art HP original, many buyers will manage to find the $500.

MORE BAD NEWS FOR DOT MATRIX

Aggressive pricing of low-end laser printers has established a bleak future for the dot matrix printer market, particularly the expensive, 24-pin end of it. Printers in that market start at around $500, and many of them produce near-laser-quality output. But they do so at an indisputable price: their noise, size, and inconvenience make the new lasers far more attractive. Even when it comes to fundamental features such as speed, font capabilities, and ease of use, the entry-level lasers win out over the older impact technology.

There's no doubt that lasers are gaining market share. In 1984, when laser printers first came on the scene, only 2 to 3 percent of new printers bought were lasers. Their great text and graphics output and their quiet operation made them very attractive, but most users simply couldn't afford them. Fortunately, times have changed: a year ago, InfoCorp estimated that 35 percent of new printers bought were lasers. Among *PC Magazine*'s readership, that number is even higher; in a study conducted last year, 47 percent of our readers surveyed said their companies planned to buy an average of 16 laser printers over the next 12 months.

The trend is sharp and clear: laser printers—particularly Hewlett-Packard's long line of LaserJets—have become the standard for office printing in corporate America. And the new LaserJet III, with its font-scaling capabilities, promises to give the high-end PostScript market competition.

THE PRINTER OF CHOICE

Desktop laser printers have always been too expensive to be considered general-purpose printers for the mass of corporate and small-business PC users. In 1984, the original LaserJet had a list price of $3,500, and more recent laser printer models have averaged $2,500—equivalent to a street price of about $1,800. Though increasingly popular, laser printers have often been considered for executive service only, and some companies will buy them solely for use on networks.

With prices below $1,000, that all changes. One good measure is a 1988 PC MagNet survey, which revealed that most readers owned or would choose to buy a dot matrix printer, but that 80 percent would change their minds and buy a laser if prices fell below $1,200. That price seemed impossible then, but today's new lasers are even less expensive, and you might want to think of them as next-generation dot matrix printers rather than low-cost lasers. That means a laser printer on every desktop is not impossible or even unreasonable. A sensible scenario is to replace dot matrix printers with inexpensive lasers attached to individual PCs, or even pairs of PCs. That would give all users in the office access to high-quality output at a reasonable cost, and silent operation throughout the office environment. If users currently depend on an expensive laser printer attached to a LAN, they wouldn't have to wait for other jobs to finish printing before seeing their output.

Many if not most applications have only low-volume output, and individual low-speed lasers will suffice. If high-volume output is a consideration, a high-performance laser can be attached to a print server in a local area network. Other applications need special forms handling, such as multipart invoices or tractor-fed card stock. Those situations can easily be handled by putting a dot matrix printer on a print server, preferably one stuffed away in a soundproof room.

Any scenario imaginable makes laser-quality printing and quiet operation available to all users in an office environment, and even to those at home. These printers open up new applications, especially graphics and desktop publishing, to more users than ever before just when high-quality graphics software is coming into its own. Low-priced lasers will be as meaningful for this industry in the '90s as dot matrix printers were in the '80s.

The trend is sharp and clear: laser printers have become the standard corporate printer.

START YOUR ENGINES

All nine low-end lasers in this roundup are respectable choices. They offer 300-dpi resolution and the capability of full-page graphics (for some, you'll have to add more memory). Most offer a LaserJet II emulation; the exceptions are the Canon LBP-4, which uses a proprietary page-description language, and the Fujitsu, which uses an outdated LaserJet Plus emulation.

The Canon and the HP IIP are based on Canon's 4-ppm LBP-LX laser engine (previously called the P110). The Dataproducts LZR 650 uses a 6-ppm engine from Sharp. The 4-ppm Okidata and the 5-ppm Fujitsu offerings are each based on a proprietary LED array engine. The Qume is based on a Casio LCS engine. The Facit, Epson, and Toshiba units are all based on a

HP LASERJET III: The Low-End Laser to Beat

With PostScript-like scalable fonts, HPGL, better graphics, and a $300 price cut, the Series II's successor outdoes the competition and costs about the same.

by Bill Howard

"Everybody's got a plan—until he gets hit" is a pearl of wisdom attributed to former heavyweight boxing champ, Mike Tyson. Similarly, the industry's laser printer makers all had great plans—until they got hit by the Hewlett-Packard LaserJet III.

Last fall, when the 8-ppm LaserJet Series II carried a list price of $2,695, 4- to 6-ppm Series II clones with $1,895 list prices made sense. But the LaserJet III, at $2,395, is so good and so affordable that there's not much maneuvering room for the competition. Or, to paraphrase Joe Lewis, "They can run but they can't hide."

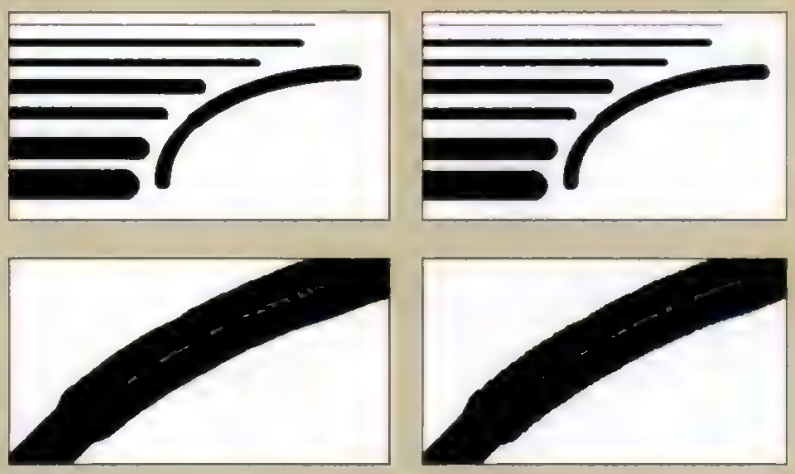
Everything about the LaserJet III is better: more fonts, crisper graphics, faster printing. PCL 5, the newest release of HP's printer control language, includes Intellifont, which provides font scaling from .25 to 999 points, font rotation, Resolution Enhancement, and HPGL/2, the latest version of HP's industry-standard plotter language. Times Roman–and Helvetica-compatible typefaces are built into the LaserJet III. If that's not enough, you can buy a pair of scalable-font cartridges with six typefaces (with 25 and 26 fonts) for $399 each, or a genuine Adobe PostScript cartridge with the same 35 fonts as an Apple LaserWriter NTX for $695 plus the cost of a 2MB memory upgrade board. Existing HP font cartridges will work in the LaserJet III, but you can't scale their fonts. Existing HP soft fonts can be made scalable in most applications.

Resolution Enhancement, HP's sophisticated smoothing algorithm reduced to an on-board chip, makes the 300-dpi Canon SX engine found in the Series II perform at a perceived 400- to 600-dpi resolution. The LaserJet III fine-tunes the size and placement of individual dots on the edges of curves and diagonal lines to reduce jagged edges, or staircasing. Take a look at the two print samples from PC Labs' performance tests; the superiority is readily apparent. Best of all, the Resolution Enhancement magic works with existing graphics software and all fonts.

The LaserJet III's print speed is roughly the same as the Series II: 8 pages per minute claimed, 7.5 ppm actual on PC Labs' text speed test—a typical two-page business letter. On our graphics speed test, the III is slightly faster than the Series II—1.9 graphics pages per minute to 1.7. For CAD and other vector drawings, you can get even faster throughput by switching into HPGL/2 mode.

Series II owners can perform a LaserJet III brain transplant for about $1,100; ditto for owners of the double-bin, print-on-both-sides IID (whose price was recently reduced by $700; it now lists for $3,595). Although you can't get an upgrade for your IIP, HP has stated it is going to bring PCL 5 capabilities to the low-end market.

The LaserJet III is so good that, to be viable, any other non-PostScript laser printer must cost a quarter to a third less. The LaserJet III should have a street price as low as $1,500 to $1,600. (While the list price is 11 percent lower than the Series II, Hewlett-Packard reportedly tightened manufacturer-to-dealer discounts slightly, so the actual selling price may not differ much from that of the Series II.) That means competing lasers must sell for around $1,000—the same as HP's 4-ppm IIP, reviewed here. Vendors sandwiched by the Series III and IIP, such as Epson and Toshiba, have already cut prices $300 to $400 so their list prices hover around $1,500. But once you see the LaserJet III's output, you'll be hard-pressed to look at another laser printer—the LaserJet III is too much of a technical knockout. ■



Resolution Enhancement gives HP's 300-dpi LaserJet III a perceived resolution of 400 to 600 dpi. Thanks to the modulation of dot size and placement, curves and angled lines lose their jagged edges. Print samples from the $2,395 LaserJet III (left) and the now-discontinued $2,695 Series II (right) show the difference.

6-ppm TEC (Tokyo Electronics Corp.) engine. All engines produced good graphics and text output, from which we were hard-pressed to distinguish. One point, however, was clear: output from the LaserJet III looked noticeably better than that of the Series II clones. In addition, close inspection revealed that the OkiLaser 400's LED engine produced slightly better output than the other 4- to 6-ppm printers.

A word about the three TEC-based printers reviewed: they're virtually identical. All three use the TEC laser engine with a 305B TEC controller, which uses a Motorola 68000 processor running at 10 MHz with 512K RAM built-in and accepts memory expansion cards up to 4MB. All support parallel and serial interfaces. With 512K RAM (the minimum we tested with), these three printers each brought home a text speed of 5.7 ppm on PC Labs' tests. Surprisingly, with more memory installed, they were *slower*, which was most noticeable in the Epson. Epson attributes this speed loss to memory overhead inherent in the 305B controller. Graphics speeds for the Facit and the Toshiba stayed the same with 512K and 1.5MB installed. But, again, the Epson suffered a performance hit with more memory. Epson attributes that slowdown to Epson firmware. Since these performance differences are slight, look for the lowest price.

FONTS & FEATURES

When choosing among the nine printers reviewed here, look closely at font capabilities. The HP IIP and the TEC-based printers all accept HP-compatible cartridges and soft fonts. The Dataproducts, Fujitsu, Okidata, and Qume accept proprietary font cards and HP soft fonts; the Okidata also includes the equivalent of six HP font cartridges. The Canon, which comes with built-in scalable fonts, does not accept HP cartridges or soft fonts. For a quick look at how each printer handles fonts, see the Fonts & Features table that accompanies each review.

Two other factors may seriously affect your buying decision: paper handling and speed. The LaserJet IIP and Canon LBP-4 can handle only 50 sheets of paper in their base configurations. While an optional, 200-sheet tray can be added, turning these printers into dual-bin models, other models tested here—such as the Dataproducts—can handle up to 250 sheets without extra charge. Most have the ability to handle special forms with less trouble than previous-generation laser printers, but pay

EDITOR'S CHOICE

- **Hewlett-Packard LaserJet IIP**
- **Okidata OkiLaser 400**

The first generations of laser printers killed off daisy wheel printers. Similarly, low-cost lasers are putting the screws to ink jet and high-end dot matrix printers. The nine 4- to 6-ppm printers reviewed here list for less than $1,700 and can be bought for as little as $850. The two best are the Okidata OkiLaser 400 and the Hewlett-Packard LaserJet IIP.

Among the nine, there are more similarities than differences in print quality. Text differences are virtually unnoticeable without close scrutiny; changing print density settings causes as much print-quality variance as changing printers. All nine provide better text and graphics quality than any dot matrix or ink jet printer. Compared with 8-ppm laser printers, these units differ most in text speed, least in print quality.

The $1,395 OkiLaser 400—which has nothing in common with the troublesome 6-ppm Ricoh-engine Laserline 6 of two years ago—is the smallest of the nine printers in this roundup and not much bigger than a VCR. The proprietary Okidata LED engine runs exactly at its claimed 4-ppm speed. By a small margin, we judged it to have the best graphics and text quality. A 150-sheet paper tray is built in. So are 17 fonts—enough, Okidata says, to replicate several popular HP font cartridges—but unfortunately not the most important, the Z cartridge (a.k.a. the Microsoft 1A). The OkiLaser doesn't accept HP font cartridges; it uses its own font cards but does support HP soft fonts.

Hewlett-Packard's $1,495 IIP is the only low-end laser that can print all portrait fonts in landscape mode (including cartridge fonts and soft fonts). While you may have read other reviews citing the IIP's print quality, PC Labs found it was only slightly above average. Text print speed was 4 ppm, both claimed and tested, while graphics speed was second only to the Qume CrystalPrint Series II. One caveat: the IIP comes with only a 50-sheet paper slot. So don't forget to include the $195 price of the 250-sheet paper tray if you're comparing equivalent costs among these printers. Serious desktop publishers will appreciate the PostScript option, a $695 device that plugs into the HP-standard font cartridge slot.

If you need faster text throughput than either Okidata or Hewlett-Packard provide, consider the Dataproducts LZR 650. Rated at 6 ppm, it achieved 6.3 ppm on PC Labs' text speed test. If you want a printer that accepts those ubiquitous HP font cartridges, look instead at one of the three TEC-engine units: the Epson EPL-6000, the Facit P6060, and the Toshiba PageLaser6. Pick whichever one has the best combination of service, support, and price. They're rated at 6 ppm and run at 5.7 ppm text speed.

We were impressed technically by the scalable-font Canon LPB-4, which uses the same 4-ppm Canon LBP-LX engine as the IIP. However, you should think long and hard before buying a laser printer that lacks any HP LaserJet emulation.

IBM's new $1,495 5-ppm LaserPrinter E arrived too late for a full-fledged review in this roundup. But based on preliminary testing of an early-production unit, it promises to be an excellent value, especially with the $499 PostScript upgrade.

Don't buy a thousand-dollar laser printer until you've seen the scalable-font Hewlett-Packard LaserJet III, which lists for $2,395 and can sell for as low as $1,500. In terms of standards, Hewlett-Packard's PCL 5 (which provides the LaserJet III's scalable-font technology) is emerging as the 800-pound gorilla of the printer industry. With PCL 5, you get virtually all the advantages of PostScript printers for about two-thirds of the cost. At present, no other 300-dpi laser matches the LaserJet III for print quality.

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CIRCLE NO. 235 ON READER SERVICE CARD

close attention to both issues when you decide what you're going to buy.

Speed is one of those questions that won't die. Epson made a big splash with an ad campaign that offered the 6-ppm EPL-6000 printer for only $4 more than HP's 4-ppm LaserJet IIP. That 2-ppm difference could mean a lot to you. Pay close attention to the PC Labs test scores to help you make up your mind; the "*PC Magazine* Guide: Inexpensive Laser Printers" will enable you to compare the text and graphics speed scores of all nine printers at a glance.

When choosing a printer, you should consider font capabilities, paper handling, and speed.

Finally, before you choose one of these low-end lasers, consider carefully the LaserJet III. Built into the LaserJet III are the most recent versions of both PCL (Printer Control Lanaguage) and HPGL (Hewlett-Packard Graphics Language). With better output, internal scalable fonts, and faster speed than any of the low-end lasers reviewed here, the III may well be worth the extra $500.

HOW TO READ THE FONTS & FEATURES TABLES

Each review is accompanied by a Fonts & Features table that shows you what features or enhancements are available with each font offered under one emulation, usually the LaserJet Series II.

We've shown what features are available with four common fonts—Helvetica, Times, Courier, and Line Printer—in four different point sizes—8/9, 10, 12, and 14. Since one of our low-cost laser printers, the Canon LBP-4, lets you choose a font in any size you want, we've also included Scalable. Please note that for some printers, what we call a feature (the bold enhancement to the Courier font, for example) is actually a separate font—called *Courier Bold* in Hewlett-Packard–ese.

For samples of some of the fonts and features for each of our low-cost lasers, see the text output in the *PC Magazine* Printer Guide.

Epson EPL-6000

Fonts & Features

HP LaserJet Series II

	Helvetica				Times				Courier				Line Printer			
	Bold	Italic	Sub/super	Underline	Bold	Italic	Sub/super	Underline	Bold	Italic	Sub/super	Underline	Bold	Italic	Sub/super	Underline
8/9-point																
10-point																
12-point																
14-point																
Scalable																

The EPL-6000 accepts HP cartridges and soft fonts. Surprisingly, the Epson emulation is optional.

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HOW TO READ THE PRINTER GUIDE

Graphics Time
To find out how long you'll have to wait for each printer to output a typical graphics image, take a look at how long it took to print our scanned photo, reported in minutes and seconds.

Graphics Speed
In addition to reporting the actual time each printer took to output the scanned photo, we've converted that time to a rate we've named graphics pages per minute (gppm), and have shown with a bar chart. We've also included the name of the emulation under which the graphics image was produced.

Text Speed
Rather than relying on the rated speed supplied by each printer manufacturer, PC Labs timed each printer's text and graphics output speeds. The reported text speed tells you the rate at which each model reviewed printed out 10 copies of our Arthur D. Author test—a two-page, single-spaced business letter. Results are reported in pages per minute (ppm).

Graphics Output
At PC Labs, we tested each low-cost laser printer's ability to handle graphics output with this scanned photo of associate editor Mary Kathleen Flynn, which was taken specifically for the test and contains many shades of gray. We've included this graphics sample to make it easy for you to compare the printers' halftone output.

LASER PRINTER — $1,000

Canon engine-based 4-ppm laser printer with landscape printing of fonts; accepts HP cartridges and soft fonts.

Graphics Output
In addition to our scanned photo, these lines appear on our test graphics page. They show you how each printer handles lines of varying widths, as well as curved lines. For a close-up look at how the LaserJet IIP and the new LaserJet III did on this test, see "HP LaserJet III: The Low-End Laser to Beat."

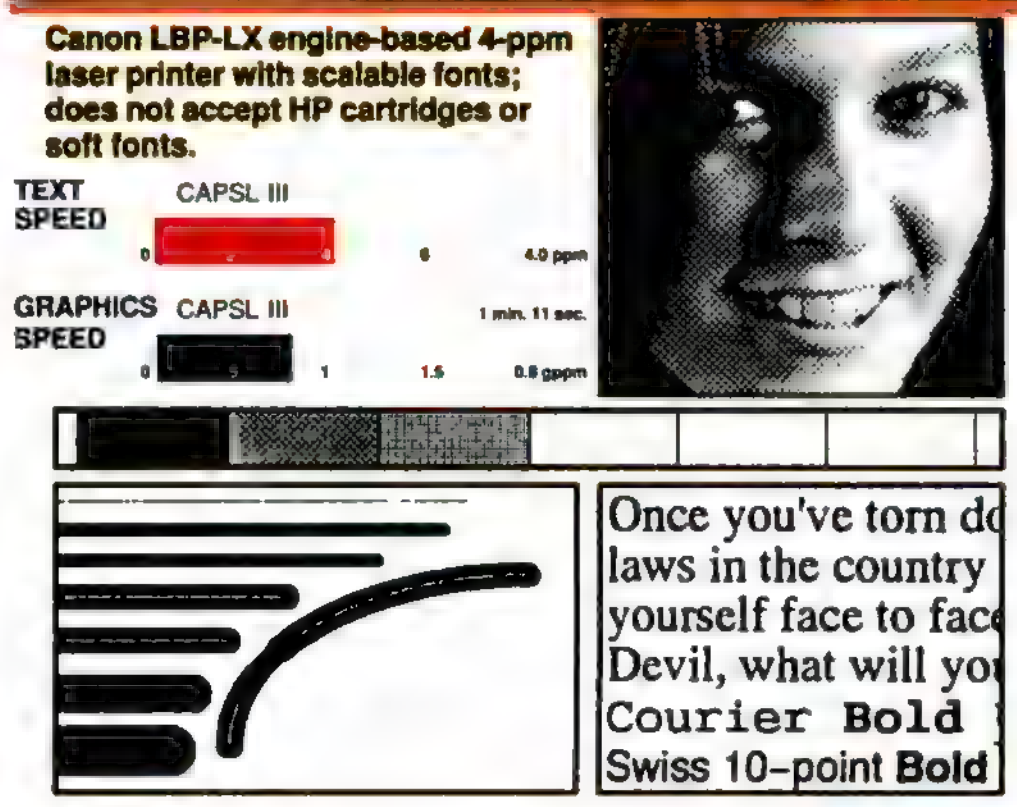
Text Output
To see how the text output from each of our low-cost laser printers compares, read the quote, loosely adapted from *A Man For All Seasons*, which offers a sample of fonts and features. And for a list of which features are available with fonts under certain emulations, see the Fonts & Features table accompanying each review.

Bar Charts
To compare the speeds of our low-cost laser printers, see the bar charts in the Printer Guide. Each actual speed is accompanied by a read-at-a-glance bar chart. On all printer speed bar charts in this roundup, longer bars mean faster printer output.

Gray-Scale Output
In the *PC Magazine* Printer Guide to Inexpensive Lasers, we've included six shades of gray output from each printer. Comparing the gray-scale and the scanned photo image will give you a good sense of how each printer handles halftones.

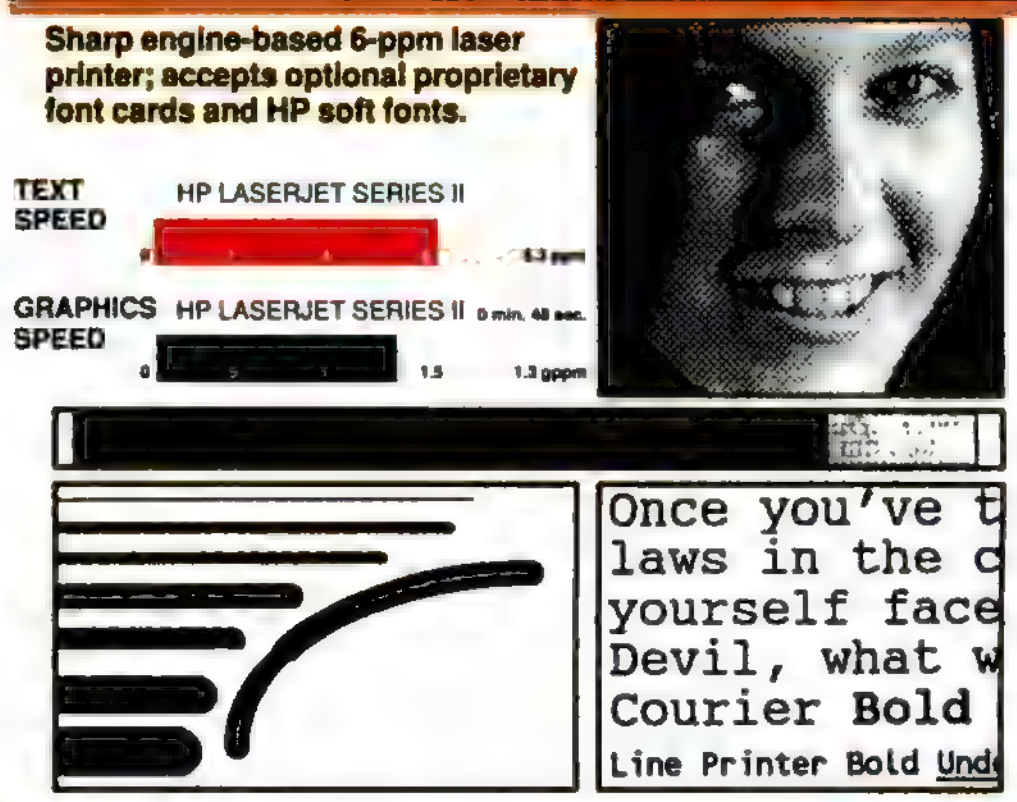
CANON LBP-4 — $1,545

Canon LBP-LX engine-based 4-ppm laser printer with scalable fonts; does not accept HP cartridges or soft fonts.



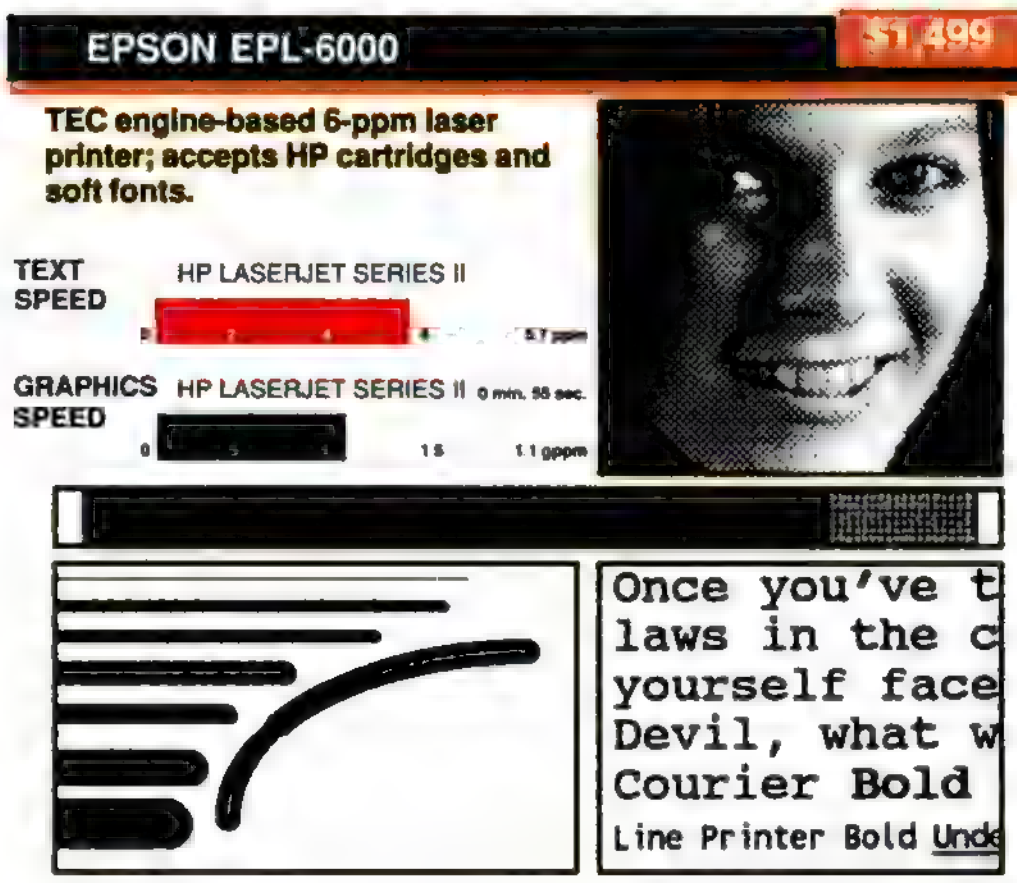
DATAPRODUCTS LZR 650 — $1,695

Sharp engine-based 6-ppm laser printer; accepts optional proprietary font cards and HP soft fonts.



EPSON EPL-6000 — $1,499

TEC engine-based 6-ppm laser printer; accepts HP cartridges and soft fonts.



FACIT P6060 — $1,595

TEC engine-based 6-ppm laser printer; accepts HP cartridges and soft fonts.

TEXT SPEED — HP LASERJET SERIES II 5.7 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 0 min. 55 sec 1.1 gppm

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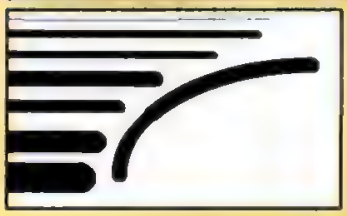
OKIDATA OKILASER 400 — $1,395

Okidata engine-based 4-ppm LED printer with 17 resident fonts; accepts optional proprietary font cards and HP soft fonts.

TEXT SPEED — HP LASERJET SERIES II 4.0 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 0 min. 51 sec 1.2 gppm



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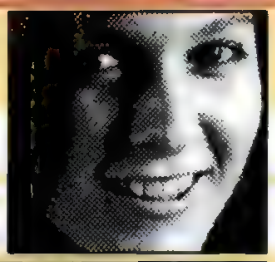
FUJITSU RX7100 — $1,495

Fujitsu engine-based 5-ppm LED printer; accepts optional proprietary font cards and HP soft fonts.



TEXT SPEED — HP LASERJET SERIES II 5.4 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 1 min. 21 sec 0.7 gppm

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QUME CRYSTALPRINT SERIES II — $1,499

Casio engine-based 6-ppm LCS printer; accepts optional proprietary font cards and HP soft fonts.

TEXT SPEED — HP LASERJET SERIES II 5.8 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 0 min. 34 sec 1.7 gppm

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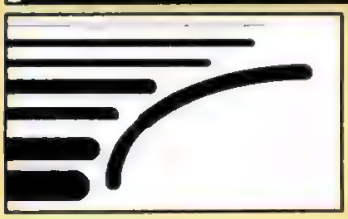
HEWLETT-PACKARD LASERJET IIP — $1,495

Canon engine-based 4-ppm laser printer with landscape printing of fonts; accepts HP cartridges and soft fonts.

TEXT SPEED — HP LASERJET SERIES II 4.0 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 0 min. 47 sec 1.3 gppm



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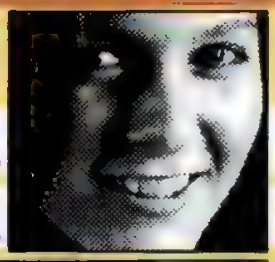
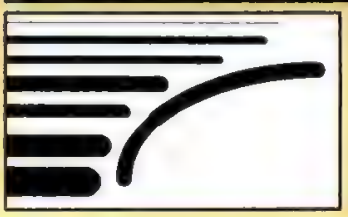
TOSHIBA PAGELASER6 — $1,549

TEC engine-based 6-ppm laser printer; accepts HP cartridges and soft fonts.



TEXT SPEED — HP LASERJET SERIES II 5.7 ppm

GRAPHICS SPEED — HP LASERJET SERIES II 0 min. 55 sec 1.1 gppm



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CIRCLE 135 ON READER SERVICE CARD

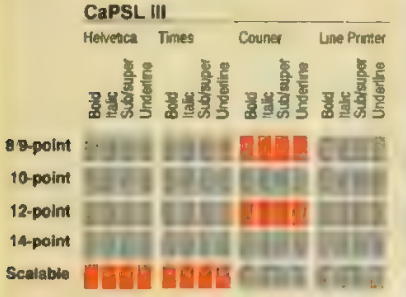
Canon LBP-4

by Mitt Jones

The Canon LBP-4 says a lot, both about what Canon cannot do and what Hewlett-Packard cannot or will not do. Nearly identical in appearance—its control panel notwithstanding—to the HP LaserJet IIP, the LBP-4 is based on the same 4-ppm Canon LBP-LX engine (previously known as the P110) and carries a list price of $1,545—$50 more than the IIP. Like the IIP, the LBP-4 suffers from the same paper-handling limitation: in its standard configuration, the machine accepts only 50 sheets of paper at a time in a flip-down, multipurpose tray. The differences between the two machines lie in a few key areas: emulations, native font capability, and memory and font expansion.

Canon LBP-4

Fonts & Features



The only printer reviewed here with built-in scalable fonts is flawed by its lack of any LaserJet emulation.

The 8- by 13.5- by 26.75-inch (HWD) LBP-4's biggest problem stems from its marketing agreement with Hewlett-Packard: the LBP-4 fails to offer the all-important LaserJet Series II emulation—or any LaserJet emulation for that matter. With only the Diablo 630 emulation, the printer depends primarily on Canon's own CaPSL III, the Canon Printing System Language III, well supported by most major software vendors though not as universally as the HP drivers.

The LBP-4 and IIP are incompatible in other areas, too. The LBP-4 memory cards use a different connector from those of the IIP, and the LBP-4 will accommodate a maximum of only 2.5MB RAM, compared with the IIP's 4.5MB. While the LBP-4 will accept two proprietary font cards, the IIP accommodates one font cartridge. And the LBP-4 will not accept LaserJet-compatible downloadable fonts.

The LBP-4's strongest asset is its font capability. While the IIP provides a collection of bitmapped Courier fonts, the LBP-4 supplies a few of those plus a nice collection of scalable fonts: Dutch Roman (which looks a lot like Times Roman) and Swiss (which is similar to Helvetica), both in bold, italic, and bold-italic fonts.

Canon's font cards, which are compatible with the Canon LBP-8 Mark III (reviewed in *PC Magazine*, "Laser Printers: A Broader Spectrum," November 14, 1989), range in cost from $195 to $295. The SC-1 scalable font card, which sells for $195, has most standard PostScript typefaces, including Avant Garde, Bookman, and Century Schoolbook. Canon has also announced future availability of PostScript and IBM Proprinter emulation cards.

The LBP-4 routes paper through an S-shaped path facedown onto its upper surface or through a C-shaped path onto a tray that can be attached at the front. With no straight-through path for heavy stock, the printer handles paper from 16 to 28 pounds, according to the vendor.

As with the LaserJet IIP, you'll probably want to dish out another $195 for the optional paper cassette. Screwed to the bottom of the printer, it holds 250 sheets of paper. You get the convenience of printing from two paper bins—the flip-down tray and the cassette. Paper trays for the optional cassette feed, priced from $69 to $89, are available in a variety of sizes including letter, legal, A4, and envelope.

The LBP-4 includes a video interface port for those who want to enhance print quality or speed by attaching a third-party controller such as the LaserMaster LX6. The LaserJet Series II offers such a port but the IIP does not.

The LBP-4 couldn't handle our graphics test with its standard 512K RAM. With 1.5MB RAM installed, however, it churned out graphics at an average of .8 gppm on PC Labs' tests—still slow in comparison with the IIP's 1.3 gppm. The Canon appeared to allow a bit more detail in our test graphics image, but the difference was noticeable. Like the IIP, the LBP-4 completed PC Labs' text speed tests at a rate of exactly 4 ppm.

Getting the LBP-4 up and running is a breeze, thanks primarily to Canon's wonderful engineering. The EP-L cartridge, which combines the toner and photoconductor drum into one package, slides easily into the front of the machine. The toner is rated for 3,500 pages, and replacements list for $95.

Canon's user manual and separate installation manual contain the information you'll need to get the printer going, but that's about all. With no index, no explanation of some key error codes, and no list or explanation of CaPSL III commands, the user manual will not take you far if you run into problems after setup. The $190 three-volume programmer's manual provides experienced programmers with the information they need.

The Canon LBP-4 is a truly wonderful machine that should sell at an attractive price. But if, like most of us, you need LaserJet emulation, you'll have to look elsewhere.

FACT FILE

Canon LBP-4
Canon USA Inc., One Canon Plaza, Lake Success, NY 11042; (800) 441-5454, (516) 488-6700.
List Price: $1,545; optional paper cassette attachment, $195; upgrade to 1.5MB RAM, $495; upgrade to 2.5MB RAM, $840; font cards, $195 to $295.
Standard Warranty: 1 year parts and labor.
Dimensions (HWD): 8 x 13.5 x 26.75 in.
Weight: 26.5 lbs.
Emulations: Diablo 630, Canon LBP-8.
In Short: The 4-ppm Canon LBP-4 gets high marks for its internal scalable fonts, small cabinet, and economy, but lacks any LaserJet emulation, making it difficult to recommend to most buyers. Paper input is limited to 50 sheets without the optional paper cassette.

CIRCLE 402 ON READER SERVICE CARD

Dataproducts LZR 650

by Mitt Jones

One of the newest low-cost lasers, the Dataproducts LZR 650 also ranks among the

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210/320Mb	10/12ms	N/A	N/A
MTBF (Hours)	60,000	<25,000	60,000
Compatibility	PC,PS/2, Macintosh	PC,PS/2, Macintosh	PC,PS/2 N/A
Capacity Range	40-320 Mb	21-44 Mb	21-42 Mb
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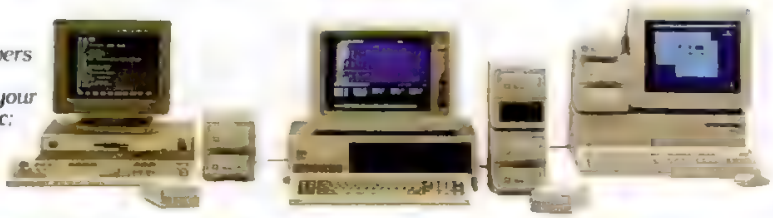

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CIRCLE 317 ON READER SERVICE CARD

most enticing. Offering 6-ppm speed, five emulations, and a 250-page paper cassette standard, the LZR 650 beats most of the low-end competition hands down when it comes to features. And at $1,695 (that's about $1,200 on the street), its price is competitive.

Based on a Sharp engine, the LZR 650 measures only 10.5 by 13.25 by 14.5 inches (HWD) with its paper cassette installed and occupies a footprint of only 13.25 by 13.75 inches (WD). Not even Hewlett-Packard's LaserJet IIP can claim such svelte dimensions.

The printer emulates the HP LaserJet Series II, the Epson FX, the IBM Proprinter (9-pin only), the IBM Graphics Printer, and the Diablo 630. Resident fonts available for each emulation match but do not exceed the resident fonts of the real printers.

Two slots along the bottom left of the cabinet accept Dataproducts' font cards, which range in price from $149 to $239 and are software compatible with HP fonts. The LZR 650 also accepts HP-compatible downloadable fonts, and each printer comes with a coupon for AGFA Compugraphic's *Type Director*, with two free downloadable fonts. Dataproducts sells additional AGFA Compugraphic soft fonts at $195 a package. Behind the font-card slots is a third slot, which takes up to 4MB of additional RAM in a single slide-in cartridge. The cartridges range in price from $549 for the 1MB version to $2,199 for 4MB.

Rounding out its virtues, the LZR 650 offers more paper-handling options than many higher-priced competitors. For $369, you get an additional 250-sheet paper cassette for a total of 500 sheets—200 more than the IIP with its optional cassette. The paper cassette attaches to the bottom of the machine, adding about 2.5 inches to the printer's height and 2 inches to the front. For another $399, you can also add a 40-envelope feeder, which attaches to the manual feed slot at the front of the machine. According to the vendor, the manual feeder allows the use of up to 31-pound stock via the straight-through paper path, if the optional paper feeder isn't installed.

In PC Labs' tests, our evaluation unit performed admirably. Under the LaserJet Series II emulation, the graphics output looked every bit as good as the IIP's, and printed just as quickly. The LZR 650 fared even better on text speed, beating its own 6-ppm rating with a speed of 6.3 ppm.

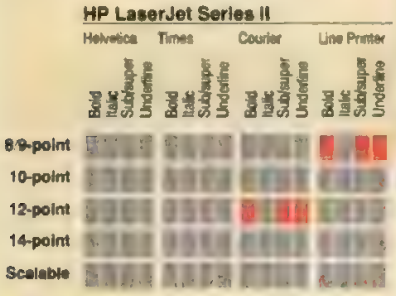
Dataproducts' prodigious offering has only one significant flaw: a frustrating setup. Upon unpacking the printer, you'll find five separate pieces to install inside the machine—the roller cleaner, the used toner collector, the drum cartridge, the developer cartridge, and the toner cartridge. While some of the pieces are easy to spot, others aren't, and Dataproducts didn't bother to label the parts. The documentation, which is sometimes inaccurate, does include diagrams, but they're too small to allow much detail. For those of you with a VCR handy, the training video supplied with the printer should help.

Dataproducts rates the $60 toner cartridge at 3,000 pages, the $132 developer at 25,000 pages, and the $169 drum at 50,000 pages, for a total per-page cost (excluding paper) of 3 cents—the same as the Hewlett-Packard IIP.

With all this, the Dataproducts LZR 650 represents a remarkable value. Whether you should choose it over the LaserJet IIP depends on your priorities. With its optional paper cassette, the LaserJet IIP costs about the same as the LZR 650 and can print from two paper bins. The IIP also carries the advantages of unquestionable HP software and hardware compatibility, not to mention a neater solution to consumables. On the other hand, if the Dataproducts' speed, range of emulations, or optional paper-handling features are important to you, it may be just the printer you need. It's certainly a practical printer for office workhorse applications.

Dataproducts LZR 650

Fonts & Features



The LZR 650 comes with emulations for LaserJet Series II, Epson FX, IBM Proprinter, and IBM Graphics.

PC FACT FILE

Dataproducts LZR 650
Dataproducts Corp., 6200 Canoga Ave., Woodland Hills, CA 91365; (800) 624-8999 ext. 583
List Price: $1,695; optional second paper cassette attachment, $369; envelope feeder, $399; upgrade to 1.5MB RAM, $549; upgrade to 4.5MB RAM, $2,199; font cards, $149 to $239; AGFA Compugraphic *Type Director* and two soft fonts, free with coupon; others, $195.
Standard Warranty: 1 year parts and labor.
Dimensions (HWD): 10.5 x 13.25 x 14.5 in.
Weight: 33 lbs.
Emulations: HP LaserJet Series II, Epson FX, IBM Proprinter (9-pin), IBM Graphics Printer, Diablo 630.
In Short: With a text speed of over 6 ppm, five emulations, and a wealth of paper-handling options, the Dataproducts LZR 650 represents a remarkable value at its projected street price of $1,200. Drawbacks include separate toner, developer, and replacement cartridges, making setup and maintenance difficult.

CIRCLE 403 ON READER SERVICE CARD

Epson EPL-6000

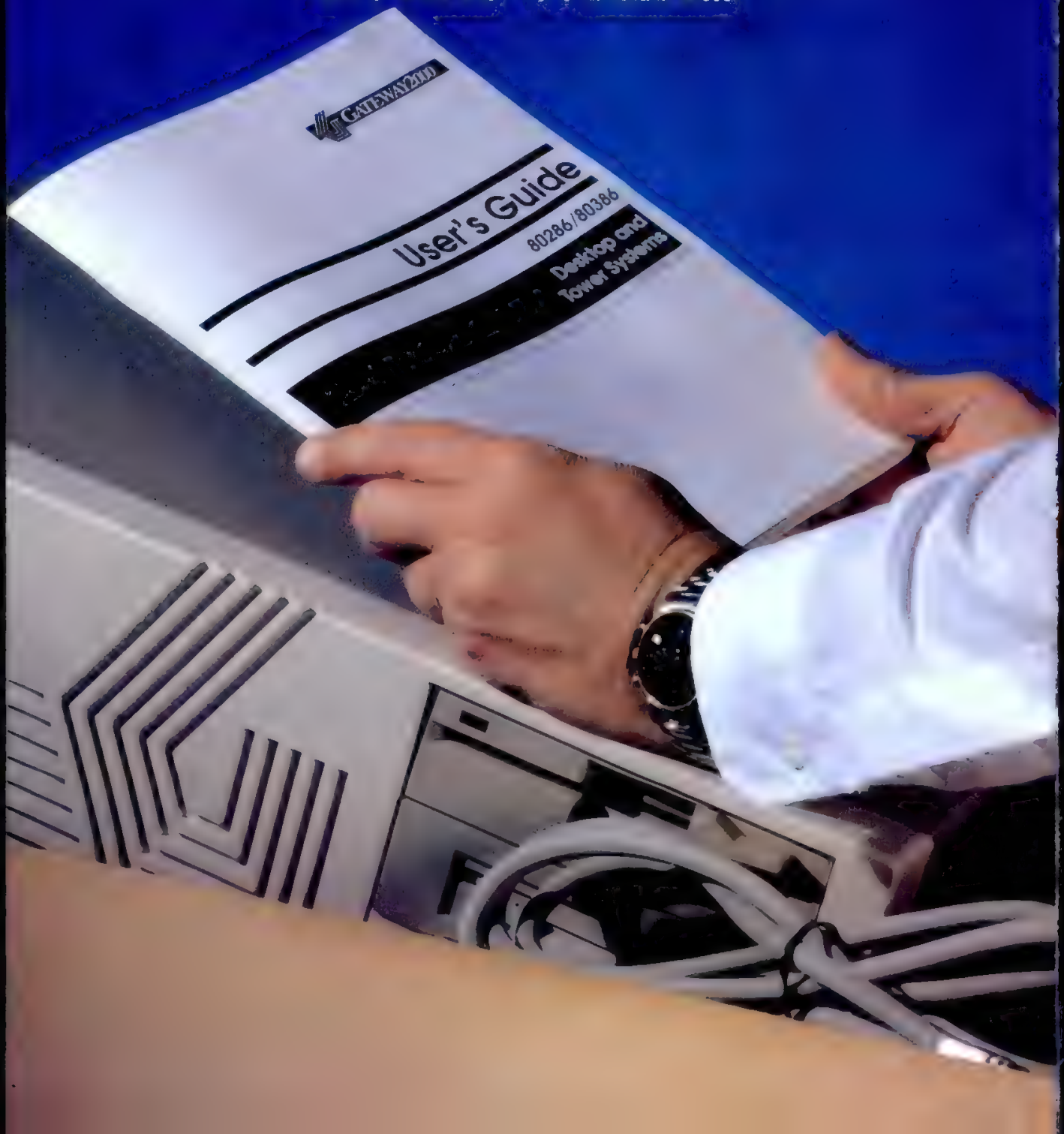
by Bill O'Brien

In the world of dot matrix printers, practically everyone emulates Epson. But even Epson recognizes the reigning laser printer emulation: Hewlett-Packard. In a not-so-surprising twist, Epson's $1,499, 6-ppm laser printer offers only the Hewlett-Packard LaserJet Series II emulation. If you want your EPL-6000 to emulate other Epsons, you'll have to buy the $229 Epson FX emulation cartridge.

The EPL-6000 is virtually identical to the Facit and Toshiba units reviewed here. All three use TEC's 1305B engine and controller—which has a Motorola 68000 processor running at 10 MHz and comes with 512K RAM, expandable up to 4MB. The TEC-based printers support both parallel and serial interfaces and come standard with a 150-sheet paper tray.

Epson's diminutive 8.5- by 24.25- by 14.5-inch (HWD) printer arrives dry with all the necessary supplies neatly and firmly secured in styrofoam. Accompanying this well thought-out package, the EPL-6000's user manual might be Epson's best effort

THOUSANDS OF PEOPLE DO THIS EVERY WEEK...



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25 MHZ 486 VGA

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- 1.2 Meg 5¼" Drive
- 1.44 Meg 3.5" Drive
- 150 Meg ESDI Drive
- ESDI Controller with 32K Cache
- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01

$5295.00

This device has not been approved by the Federal Communications Commission. This device is not, and may not be offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

WE'LL TELL YOU WHY

Ray: That's where we shine. Gateway's tech support is the best in the industry. We know what we're talkin' about, but most importantly, we care. We'll bend over backwards to take care of you. You won't hear us saying, "Sorry ma'am, that's a software problem." We don't care whose problem it is. If the machine is not working for you, we'll do everything in our power to get you up and running.

Ted: What if you can't fix a problem over the phone?

Ray Kayl, Technical Support Manager

Ray: Then we can send a technician to almost anyplace in the nation.

Ted: Kathy—bet you thought I forgot you—what about customer service?

Kathy: Customers get very personal service here. When you call Gateway, you'll be assigned to one customer service representative who will follow your order from start to finish. Your personal rep will make a special effort to get to know you and make sure you're completely satisfied.

Kathy Skidmore, Customer Service Manager

Norm: Hey, this sounds almost too good to be true.

Ted: Some people think that. But our customers don't—ask them. They know Gateway 2000 is the best value in the industry.

Norm: Do we have an ad yet?

Ted: Yeah, I think so. All I have to do is cut some prices on our systems. Then get ready for a really hot summer...(Tape End Indicator.)

Norm Waitt, Vice President

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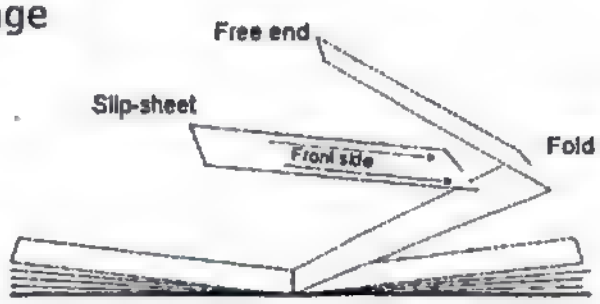
CIRCLE 364 ON READER SERVICE CARD

Folded edge of the page

GbsSlipSheet-001

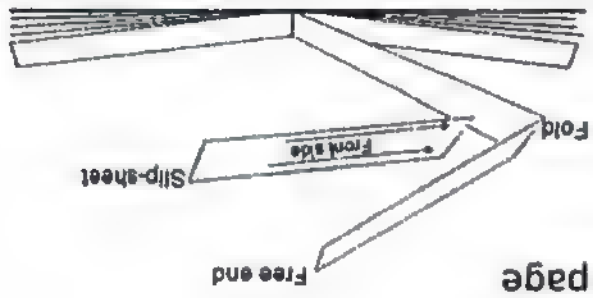
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

GbsSlipBack-001B

Back

1. Follow instructions on the other side

1. Follow instructions on the other side

PULL UP A CHAIR AND

Ted: OK, we're putting together another ad for the magazines and I thought you should be the ones to write it.

Todd (laughing): Hey, Ted, I'm no writer.

Ted Wait, President

Ray: Me neither. Don't you s'pose we could hire somebody to write our ads? (Laughter.)

Ted: No, because we've always been straight forward in our advertising. I've analyzed the market and I can't understand why anyone would buy a computer from anyplace except Gateway. Now I know you all agree with me, so I want you to tell the world what you can do for them. Just straight talk from a friend in the business. I'm recording this—

Troy: Is this legal?

Ted: —and I'm gonna give the tape to word processing for a transcription. And that's gonna be our ad.

Norm: This oughta be good! (Laughter.)

Ted: Todd, you're on. I'm looking for a computer system. Why should I buy from Gateway 2000?

Todd: Because Gateway has the best value. We lead the market in price, quality and service. It's that simple. You wanta get the best system for the best price from a company you can depend on? Then buy from Gateway 2000.

Todd Osborn, Sales Manager

Troy: Yeah, shop around. But don't be fooled by stripped-down systems. Compare Gateway feature for feature and we blow the competition away.

Norm: And read the reviews. Our systems out-perform machines that cost twice as much.

Ted: Troy, you're on. You run the plant so you tell me what kind of quality I can expect?

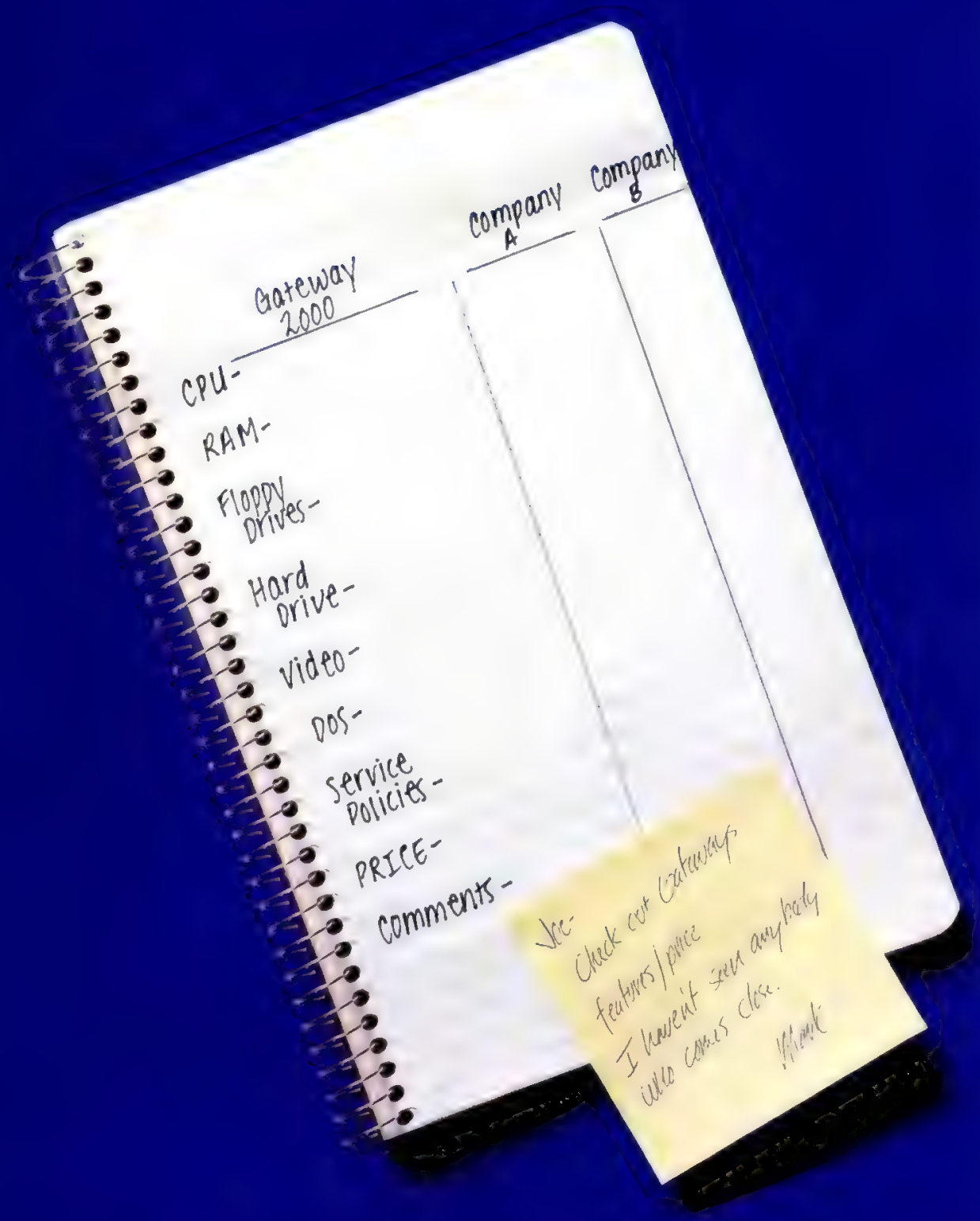
Troy Miller, Plant Manager

Troy: Well we use a component that's not very common today—pride. Each machine that goes out the door is custom-built by one person. That person's pay is determined by how satisfied you are as a customer. We use only top-of-the-line components. You combine that with the midwest work ethic and you've got an unbeatable combination.

Ted: OK, Gateway's got great prices on quality systems. But we can't guarantee everyone that they'll never have a problem.

Ray: If we could, I'd be out of a job. (Laughter.)

Ted: Yeah, Ray. Tell me about your job. What happens if a customer does have a problem?



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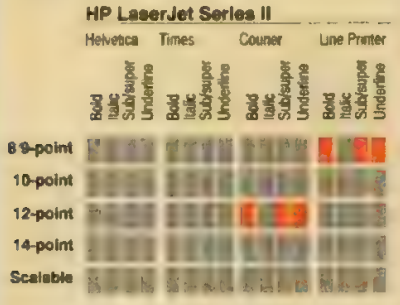
Epson EPL-6000

Fonts & Features



The EPL-6000 accepts HP cartridges and soft fonts. Surprisingly, the Epson emulation is optional.

yet. It will walk you through the installation of the photoconductor and toner subassemblies in under 10 minutes, and leave your shoes free of toner smudges.

Paper loading is a snap with the 150-sheet bin. Epson claims that the printer will handle 14- to 34-pound paper. The 16-pound-and-below and the 24-pound-and-above stock is fed through the manual-feed slot on the printer's right-hand side and ejected onto a tray mounted on the left side, bypassing the normal "C-bend" for a straight-through paper path. The same tray can be used to switch-select between reverse and collated output and, fortunately, the tray can be folded up and out of the way when not in use, relieving the EPL-6000 of an additional 11 inches of width. Envelopes can also run through the manual-feed slot.

The base machine is supplied with 512K of memory—an amount adequate for text but only enough for about half a page of graphics. For larger graphics files or those containing more-complex bit images, memory upgrades are available from Epson via an expansion board priced at $899. The board comes with 2MB and can be upgraded to 4MB, bringing the total to a hefty 4.5MB.

Even with only 512K installed, the EPL-6000 found the PC Labs' graphics speed test no great challenge. The test image ran through the printer at 1.1 gppm. The graphic image was crisp and sharp with well-defined edges. The printer also fared well on PC Labs' text speed test, averaging a remarkable 5.7 ppm.

Like the other TEC engine-based lasers reviewed here, the EPL-6000 successfully accomplished the torturous twists and turns of the PCL compatibility test, giving it a full passing grade, including soft font recognition. Only the IBM high order characters gave the EPL-6000 pause: the printer defaulted to the Roman symbol set. But that was easily overcome by sending a control code to the printer to switch to its IBM-USA symbol set. Alternatively, the same symbol set can be selected via the front control panel, which deserves special notice.

The control panel's 16-character LCD is an excellent window into the brain of the EPL-6000. The panel's primary function is to give full access to all the setup options, including default font selections if you are using any HP or HP-compatible font cartridges, or soft fonts designed for the HP. The control panel also lets you select between manual and automatic paper feed and perform a form-feed for printing data left over in the printer's buffer. Unfortunately, the form-feed key is labeled Reset/Continue, ostensibly to emphasize its other function, but causing some confusion nevertheless.

Perhaps the only thing lacking in the EPL-6000 is an Epson emulation; this one inclusion would have made the printer perfect. As is, it's merely outstanding—though with two twins in this roundup, it doesn't exactly stand out.

PC FACT FILE

Epson EPL-6000
Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (800) 922-8911, (213) 539-9140
List Price: $1,499; upgrade to 2MB, $899; Epson emulation, $229.
Standard Warranty: 1 year parts and labor, dealer or depot service.
Dimensions (HWD): 8.5 x 24.25 x 14.5 in.
Weight: 36 lbs.
Emulations: HP LaserJet Series II.
In Short: Like the other two TEC engine-based 6-ppm lasers in this roundup—the Facit and the Toshiba—the EPL-6000 comes with a 150-sheet paper tray and accepts HP cartridges and soft fonts. To choose among the three, look for the lowest price or go with your favorite vendor.

CIRCLE 404 ON READER SERVICE CARD

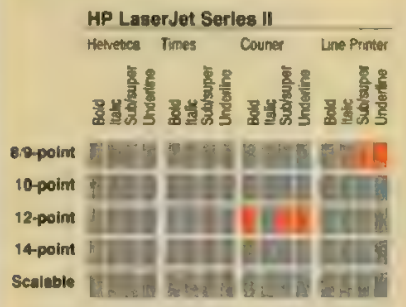
Facit P6060

by M. David Stone

Like the Epson and Toshiba units reviewed here, the $1,595 P6060 is based on the TEC 6-ppm laser engine and offers no surprises—except for a list price about $50 higher than the Toshiba and almost $100 higher than the Epson.

Facit P6060

Fonts & Features



The Facit P6060 accepts HP cartridges and soft fonts. Only the LaserJet Series II emulation comes standard.

The P6060—which was reduced to its current price from $1,995 in December of 1989—also lists for $100 more than the LaserJet IIP. Rated at 6 ppm, the P6060 is 50 percent faster than the 4-ppm IIP. And if you take HP's $195 optional paper tray into account, you'll see that the price difference works in the P6060's favor; the P6060 gives you a 150-sheet paper tray, as do the other TEC-based units.

The standard paper tray includes both a manual-feed slot and an internal width adjustment that will let you use any paper from about 3.25 to 8.5 inches wide. In addition, a hidden extension flips out to support legal-length paper. A facedown bin in the printer's top lets the paper fall in collated order. Facit claims that its printer can handle paper with weights from 14 to 34 pounds. An alternate side exit provides a straight-through path for paper below 16 and above 27 pounds. A $35 output tray for the alternate paper path is available as well. For more-sophisticated paper-handling, the 8.5- by 24- by 15.5-inch (HWD) Facit also offers a $1,295 two-plus-one sheet feeder option that includes two 220-page bins and one 50-envelope bin.

The P6060 comes with 512K standard memory, and upgrades can be purchased

in the following increments: 1MB for $395, 2MB for $995, and 4MB for $1,895—bringing the machine up to its maximum of 4.5MB.

The output from the Facit's TEC 1305B engine looks every bit as good as output from the Canon engines in our roundup. Text is dark and crisp, and black areas in graphics are indeed a true, solid black. On PC Labs' tests, the gray-scale images retained the same detail you would expect in the LaserJet Series II, and the scanned photograph output matched that of the Series II as well.

Facit P6060
Facit, Inc., 400 Commercial St., Manchester, NH 03108; (800) 73-FACIT, (603) 647-2700.
List Price: $1,595; alternate output paper tray, $35; dual-bin sheet and envelope feeder, $1,295; upgrade to 1.5MB, $395; upgrade to 2.5MB, $995; upgrade to 4.5MB, $1,895; font cartridges, $150 to $300; IBM Proprinter XL emulation cartridges, $195; soft fonts, $200.
Standard Warranty: 1 year parts and labor.
Dimensions (HWD): 8.5 x 24.0 x 15.5 in.
Weight: 35.3 lbs.
Emulations: HP LaserJet Series II.
In Short: Like the other TEC-based 6-ppm laser printers reviewed here—the Epson and the Toshiba—the P6060 offers solid LaserJet Series II compatibility and high-quality output, with crisp text characters and solid blacks in graphics mode.

CIRCLE 405 ON READER SERVICE CARD

The Facit registered 5.7 ppm on our text speed test, close to its 6-ppm rating, and the printer produced 1.1 gppm, nearly equaling the IIP's graphics output speed. The Facit passed the LaserJet Series II compatibility tests with ease.

Like the Series II it emulates, the P6060 is limited to Courier, Courier Bold, and Line Printer for its built-in fonts. The printer sports two slots for font cartridges. According to Facit, the printer will work with all HP cartridges except the S1 and S2, and will operate also with HP-compatible soft fonts. Facit sells font cartridges for $150 to $330 each, and soft fonts for $200.

The printer's manual was written in Sweden and occasionally lapses into unintelligible "Swenglish." However, the ample line drawings will get you through the installation procedure easily enough, and most of the additional information you'll need is there as well.

One minor drawback to the TEC engine is that it separates its consumables into a drum unit, a developing unit, and a toner cartridge. In theory, this cuts down on the cost of operation, but in fact, the cost per copy is more than 3 cents, excluding paper—about the same as the other printers in this roundup. The drum itself is exposed so that it's too easy to damage, and because there are more pieces to fit together, installation is more difficult than an all-in-one cartridge.

Once you get past the jigsaw puzzle of fitting the consumables together, the P6060 is a plug-and-play unit. The only built-in font emulation is LaserJet II, so installation usually means plugging in the power cord and parallel cable. If you want to use the printer's serial interface or the optional $195 IBM Proprinter emulation cartridge, you'll also need to change the configuration in the printer's menus.

The printer's control panel sports a 16-character LCD readout and four easy-to-use controls dedicated to menu-choice selection. In addition, there are the usual Online/Offline buttons, a highly welcome manual-feed control, and a thick-paper control that lets you set the printer for paper over 24 pounds. As with the other TEC-based printers, the form-feed button is labeled Reset/Continue.

Like the other TEC-based printers reviewed here, the P6060 is a solid performer that does just what it should, and does it well. At Facit's expected street price of $1,100 to $1,200, the printer's price is low enough to make it reasonably competitive, and the performance is high enough to make it a more-than-reasonable choice.

Fujitsu RX7100

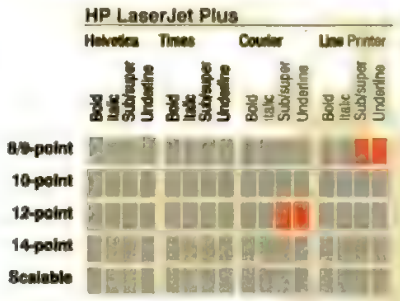
by Mitt Jones

Fujitsu's 5-ppm low-cost entry, first reviewed in our November 14, 1989, issue ("Laser Printers: A Broader Spectrum"), looks more like an odd dot matrix printer than a laser-class machine. Its paper-feed mechanism is also a bit noisier than one would hope. But with a list price of $1,495 and paper-handling options more flexible than nearly any other low-cost machine, this printer may be just what some buyers are seeking.

Based on Fujitsu's own LED engine, the printer measures 19.5 by 16 by 24.5 inches (HWD), including the front exit tray and the paper support wire of the paper bin. The paper bin itself, which installs at a slight angle from the vertical along the top of the machine, accounts for much of both the printer's odd appearance and charm. Unlike the paper cassettes used with most laser-class machines, the 150-sheet bin comes with an adjustable paper guide that allows different sizes of paper to be stacked without making you buy separate trays. Paper can be sized anywhere from 4⅛ by 5 13/16 inches to 8½ by 14⅛. Acceptable weights range from 17 to 28 pounds, according to Fujitsu. A slot toward the front of the bin provides a manual, single-sheet feed. Perhaps best of all, for $405, the printer will accommodate a second, identical bin, which installs immediately behind the first.

Fujitsu RX7100

Fonts & Features



Handicapped by an outdated LaserJet Plus emulation, the RX7100 accepts proprietary font cards and HP soft fonts.

In its standard configuration, the machine emulates only the outdated HP LaserJet Plus, and comes only with upright, regular-weight Courier and Line Printer fonts. Slots along the bottom front of the machine will accommodate as many as three proprietary font cards—priced between $145 and $195—that are software compatible with HP fonts. The machine will also accept LaserJet-compatible downloadable fonts. Any of the three slots will also accommodate an emulation card—Diablo 630, Epson FX, IBM Proprinter XL, or HPGL—which range in price from $99 to $149.

The RX7100 comes with 640K RAM

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An object lesson in how to pack multi-user features into a single-user size (1.3 square feet, 33.5 pounds):

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CIRCLE 332 ON READER SERVICE CARD

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CIRCLE 297 ON READER SERVICE CARD

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*IID duplexing feature not supported in PostScript mode.

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CIRCLE 241 ON READER SERVICE CARD

instead of the typical 512K. Optional memory boards allow a minimum upgrade of 1MB for $495 and a maximum of 4MB for $1,995. The RX7100 accommodates a parallel or a serial connection.

Getting the printer up and running should take no more than an hour. All consumables are encased in one cartridge. The cartridge doesn't install as neatly as those of the Canon engines, and the manual doesn't make installation of the cartridge as clear as it might. Nevertheless, you can't fail after studying the illustrations and the inside of the machine for a few minutes.

The RX7100 performed well, if not spectacularly, during PC Labs' tests. With straight text, the RX7100 exceeded its rated speed, clocking in at 5.4 ppm. On the graphics speed test, our evaluation unit was quite a bit slower than much of the competition, with test images coming in at .7 gppm.

Rather than tucking its print-density adjustment dial on the inside of the machine as do most lasers, the RX7100 has its dial on the front panel—a good thing, because you'll want to adjust the print to its darkest, at least for your more important documents. Though not immediately noticeable when printing pure text, the RX7100 produced a light-gray black on our graphics tests with its print density in the factory preset position. Even after turning print density to its darkest, the blacks in our test image were a bit lighter than those produced by most lasers.

Because the competition is so varied and capable, it's difficult to recommend the Fujitsu RX7100 to most buyers. By aesthetic considerations alone, it loses a few points. Add in its outdated LaserJet Plus emulation, scant selection of internal fonts, and less-than-black blacks, and it loses even more. For those who need the flexibility of two multisize bins, however, the Fujitsu RX7100—with the optional second bin—may be a good choice.

With a list price of $1,495 and paper-handling options more flexible than other low-cost machines, the Fujitsu RX7100 may be what some buyers seek.

FACT FILE

Fujitsu RX7100
Fujitsu America Inc., 3055 Orchard Dr., San Jose, CA 95134; (800) 626-4686, (408) 432-1300.
List Price: $1,495; upgrade to 1.6MB RAM, $495; upgrade to 4.6MB RAM, $1,995; font cards, $145 to $195; Diablo 630 emulation card, $99; Epson FX/IBM Proprinter XL emulation card, $129; HPGL emulation card, $149.
Standard Warranty: 1 year parts and labor, first 45 days on-site.
Dimensions (HWD): 19.5 x 16 x 24.5 in.
Weight: 37.5 lbs.
Emulations: HP LaserJet Plus.
In Short: Based on Fujitsu's own 5-ppm LED engine, the RX7100 performs competently and offers generous paper-handling options. Its drawbacks include an awkward appearance, noisy operation, outdated LaserJet Plus emulation, slightly gray blacks, and scant selection of internal fonts.

CIRCLE 406 ON READER SERVICE CARD

Hewlett-Packard LaserJet IIP

by Mitt Jones

Your biggest complaints about the HP LaserJet IIP may be that it didn't come along sooner and that it's not the LaserJet III.

The HP LaserJet IIP earned an Editor's Choice in last year's printer blockbuster ("Laser Printers: A Broader Spectrum," November 14, 1989), and for good reason. Based on Canon's LBP-LX engine (previously called the P110) the $1,495 LaserJet IIP can do almost everything the venerable $2,695 LaserJet Series II does, and a few things it can't. The IIP's print quality is just as good, and it comes with more internal fonts, adding 12-point Courier Italic and a set of 10-point Courier fonts. Like the $4,295 LaserJet IID, it can also rotate any portrait font to landscape orientation.

Like the LaserJet Series II, the IIP's 512K standard memory can be upgraded to as much as 4.5MB, and the IIP makes room for one Series II–compatible font cartridge. With a mercifully small footprint of about 13.5 by 16 inches (WD), the LaserJet IIP also requires far less office space than the LaserJet Series II, which measures about 18 by 19 inches.

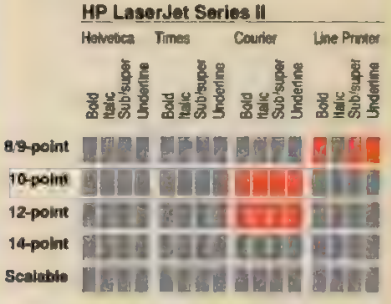
Now for the IIP's drawbacks: the IIP's lower list price brings with it one of the slowest print speeds in this roundup—4 ppm, compared to the Series II's 7.5 ppm on PC Labs' text speed test. And, in its default configuration, the IIP's only paper feed is the flip-down, 50-sheet-maximum, multipurpose tray. In the down position, the tray adds about 9 inches of depth to the printer.

With the addition of HP's optional $195 paper cassette, however, the IIP's paper-handling capabilities begin to seem like a virtue. The cassette cabinet, which screws onto the bottom of the printer, adds less than 2 inches to the machine's height and holds up to 250 sheets. Aside from the greater capacity, the cassette allows the IIP to do something the Series II can't: print from two different paper bins. The optional cassette comes with a letter-size or A4-size tray. Other trays, including legal and envelope, are also available at prices ranging from $69 to $89.

The IIP outputs pages facedown atop the machine via an S-shaped path, or face-

HP LaserJet IIP

Fonts & Features



The IIP has a good selection of internal fonts, which can be printed in landscape mode, and it accepts HP cartridges and soft fonts.

up through a slot at the front of the machine via a C-shaped path. We were able to print envelopes using the faceup feed with no crinkling or excessive curling. Though providing no straight-through path for heavy stock, the IIP can handle up to 28-pound paper, according to HP.

Hewlett-Packard has gone far to ensure that setup of the IIP is not difficult. In addition to the well-organized, informative user manual, you'll find a Getting Started Guide, which provides ample illustrations. The $95 EP-L toner/photoconductor drum cartridge, rated at 3,500 pages, slides easily into the printer from the front. The rated cost per page, excluding paper, is 3 cents. The IIP accommodates both a parallel and serial connector.

The control panel, which sports a crisp, two-line LCD panel and six large, well-marked buttons, makes changing the printer's configuration a breeze.

Aside from the internal Courier and Line Printer fonts, the IIP can accommodate plenty of bitmapped fonts via cartridge or software. All LaserJet Series II font products, marketed by Hewlett-Packard and others, will work with the IIP. HP's cartridges begin at $99 and go up to $300 for the 65-font ProCollection cartridge. Prices for HP downloadable fonts range from $95 to $225.

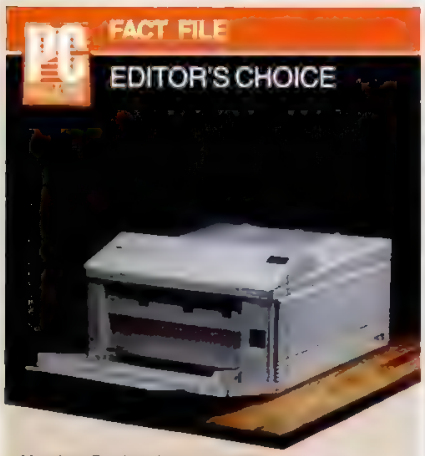
At 4 ppm, the HP LaserJet IIP is not the printer you should choose if speed is of the essence. If you want to add a print-quality enhancement board, such as the DP-Tek LaserPort GrayScale or LaserMaster LX6, you should also look elsewhere: the IIP does not support the additional I/O port such products need.

The OkiLaser 400's internal fonts save the cost of six font cartridges, and its text throughput rate is very close to the speed of printers rated at 6 ppm.

Keep in mind that the HP LaserJet III, complete with internal scalable fonts, will be shipping by the time this issue hits the newsstand, and may provide the best reason to wait (see the sidebar "HP LaserJet III: The Low-End Laser to Beat"). Although Hewlett-Packard has announced upgrades for the II and the IID to PCL 5 (the newest release of HP's page description language, which the LaserJet III supports), it is doubtful that IIP owners will be offered any similar upgrade. HP says it does plan to bring PCL 5 capabilities to the low end of the market but declines to say when or in which product.

If you need a printer for desktop publishing or other tasks that could benefit from scalable fonts, you're better off paying the $1,500 expected street price of the LaserJet III—especially if you need the optional paper cassette and any additional fonts for your IIP.

With those caveats out of the way, it's safe to say that the LaserJet IIP is the best value among the low-end lasers. If something faster and more powerful seems like overkill, the LaserJet IIP is probably just what you need.



Hewlett-Packard LaserJet IIP
Hewlett-Packard Co., 19310 Prunendge Ave., Cupertino, CA 95014; (800) 752-0900.
List Price: $1,495; optional paper cassette attachment, $195; optional paper trays, $69 to $89, upgrade to 1.5MB RAM, $495; upgrade to 4.5MB RAM, $1,980; parallel interface cable, $55; font cartridges, $99 to $300; scalable fonts, $95 to $225.
Standard Warranty: 1 year parts and labor.
Dimensions (HWD): 8 x 13.5 x 26.75 in.
Weight: 26.5 lbs.
Emulations: HP LaserJet Series II.
In Short: The 4-ppm HP LaserJet IIP sets a new standard for low-end lasers. Though lacking the scalable fonts or enhanced print quality of the LaserJet III, the IIP offers LaserJet II functionality and font compatibility at a street price of about $1,000. The $195 250-page paper cassette is strongly recommended.

CIRCLE 407 ON READER SERVICE CARD

Okidata OkiLaser 400

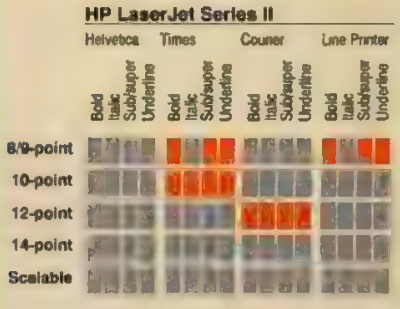
by Bill O'Brien

It's a misnomer to call Okidata's printer a laser device when it's really an LED array printer. But make no mistake about it: this $1,395 performer packs a lot of quality into a manageable 5.25- by 17.5- by 22.5-inch (HWD) case. And at 4 ppm, the OkiLaser 400 is well armed for its head-to-head fight against Hewlett-Packard's LaserJet IIP.

The OkiLaser 400 far surpasses its competition in the font department. Resident in the printer are 17 fonts equivalent to the fonts found in HP cartridges A, B, C, F, L, and Y—though Okidata is quick to point out that the baseline and underline distances for the Y-cartridge fonts are slightly different in its 400. Additional fonts, such as Letter Gothic, Pax, and Times Roman, are available on proprietary credit card–sized cartridges from Okidata for $195. Okidata will also sell you a custom cartridge programmed with your signature or company logo. Although it won't accept HP font cartridges, it will accept HP-compatible soft fonts.

Okidata OkiLaser 400

Fonts & Features



The OkiLaser has resident fonts equivalent to six HP font cartridges. It accepts optional proprietary font cards and HP soft fonts.

The printer provides a variety of paper-feed options. At first glance, there appears to be no straight-through paper path, but closer inspection reveals a rear swing-down panel with a pair of extendable forks for use as a paper-catch tray. You'll need to use this straight-through path for stock below 16 and above 24 pounds, says Okidata. There is also a manual feed for legal-size paper and envelopes. For quantity

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PC Magazine [July 1989, Page 263]:
"The Buffalo SL peripheral sharing device is simple enough to use immediately yet sufficiently flexible to form the center of a fairly complex network. It's a good choice..."

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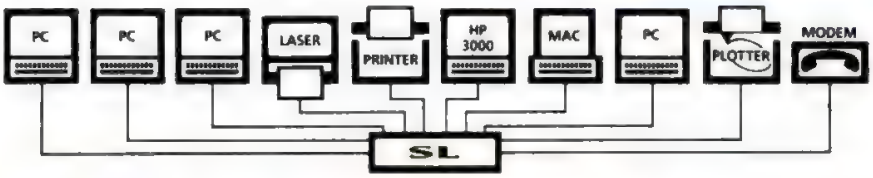

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CIRCLE 328 ON READER SERVICE CARD

printing of envelopes and legal- or executive-size pages, Okidata sells separate trays at $89 each.

The OkiLaser 400's toner cartridge is perhaps the closest thing to art deco you'll find in a printer. It's a spun aluminum cylinder with a sliding window, and while the OkiLaser has no official toner reclamation system, Okidata claims the cartridge design allows it to collect some of the unused toner from the photoconductor.

The initial package of consumables is included in the retail price. Replacement toner cartridges are $33—slightly higher than toners for some other printers—but Okidata claims a 2,500 copy life for its car-

HOT OFF THE ASSEMBLY LINE: IBM's Auspicious Answer to the Low-Cost Laser

by Mitt Jones

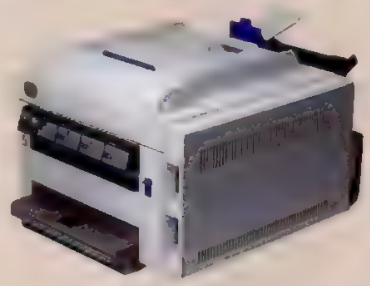
IBM's newly announced LaserPrinter E rolled into PC Labs well after the cutoff date for this roundup. With a list price of $1,495 and a generous range of options, this late entry ranks among the best buys of the bunch, especially when equipped with IBM's new $499 PostScript upgrade.

Based on the same IBM engine as the $2,395 10-page-per-minute LaserPrinter, the LaserPrinter E looks the same, boasts the same array of features, and generates the same high-quality output. The only significant difference results from the slightly redesigned controller: the LaserPrinter E is rated for a top speed of 5 pages per minute.

Like the LaserPrinter, the LaserPrinter E can be configured from the control panel to emulate the Epson Proprinter, the HP LaserJet Series II, IBM's Graphics Language, and the Hewlett-Packard Graphics Language. Two font slots, located at the right front of the machine, accept only proprietary cards—there are 48 available, ranging in price from $142 to $245—but the machine will also accept HP-compatible downloadable fonts.

The LaserPrinter E also offers generous paper-handling features, boasting an adjustable, 200-sheet paper cassette as standard equipment. A feed slot, awkwardly positioned along the printer's rear panel, accommodates the standard manual-feed tray or the optional $329 envelope feeder, which holds up to 75 envelopes. The most enticing paper-handling feature for many buyers, however, will be the $399 optional paper tray, which fits under the machine and holds up to 500 sheets. Both the standard and optional paper trays come with movable partitions allowing you to adjust for standard paper sizes up to 8.5 by 11 inches. (Legal-sized trays cost $69 and $99.)

The LaserPrinter E comes with standard 512K RAM. Additional RAM, up to 3.5MB, comes in the form of a small daughtercard, which attaches directly to the controller board. With a welcomed and unusual touch, IBM designed the chassis so that even the most numb-fingered user can get to the con-



The LaserPrinter E offers better value than its faster, more expensive sibling.

troller in a matter of seconds. The right-side panel pops open by lifting a plastic tab and pivots out and down to reveal the controller, the memory expansion connector, and the controller's 10-MHz Motorola 68000 processor. The memory board ($449 with 1MB, $899 with 2MB, and $1,599 with 3.5MB) snaps easily into place.

Once endowed with at least 1MB of memory, the LaserPrinter E can accommodate IBM's PostScript upgrade board, which provides genuine Adobe PostScript, Version 52.1, and can be installed by the user. This requires removing four chips from the controller (IBM provides the chip-removal tool and illustrated instructions), inserting the daughtercard into two of the vacated sockets, and installing one jumper.

The basic PostScript option retails for $499 and comes with 17 fonts, encompassing Courier, Helvetica, Helvetica Narrow, Times, and Symbol typefaces. The $899 Premium PostScript option adds 39 fonts, which include ITC Avant Garde Gothic, ITC Bookman, New Century Schoolbook, and Palatino typefaces, among others.

IBM has also announced a replacement controller that will upgrade the LaserPrinter E to the full 10-ppm performance of the LaserPrinter. The upgrade, which must be installed by an IBM dealer, lists for $1,099.

The replacement toner-and-drum cartridge, which includes all consumables and slides easily into place, lists for $199. While this is higher than Hewlett-Packard's $95 cartridges for the IIP, IBM rates its cartridge life at 10,000 pages, about three times the life of the IIP's. Other options include a six-port $489 serial printer-sharing option. The LaserPrinter E comes with only a parallel interface standard.

Our evaluation machine, an early-production unit, worked well during preliminary testing, clocking in at 4.8 ppm on PC Labs' text speed tests. With the Premium PostScript option installed, text speed actually increased slightly—to 5.8 ppm in non-PostScript modes and 5.6 ppm in PostScript mode.

The printer performed surprisingly well with graphics and, in fact, matched the graphics performance of its 10-ppm sibling at about 1.9 graphics pages per minute on PC Labs' graphics speed test. Not surprisingly, graphics speed decreased in PostScript mode to .6 gppm.

Print quality compared favorably to the best of the 300-dot-per-inch lasers overall. Our only complaint was that areas of solid black shone more than similar print samples from the IIP.

Based on our preliminary findings, the LaserPrinter E is an excellent buy. In its standard configuration, it outperforms much of the competition and rivals the best in features and price. Add the $499 PostScript option and the $449 1MB memory upgrade, and you've got a versatile PostScript printer for a bargain list price of $2,443.

And when compared with its faster sibling, the LaserPrinter E looks even

tridge. The $289 photoconductor has a reported life span of 15,000 copies—50 percent more than a TEC laser engine, but at double the cost. The OkiLaser 400 can be connected to your parallel or serial port.

Four manuals accompany the OkiLaser 400 and they divide the information into logical segments covering setup, owner's questions, elements of graphic composition, and problem areas. The setup manual is superb, guiding the meek through the toner and photoconductor installation with full illustrations to accompany the text. The manual even describes the correct method of inserting the 200-sheet paper tray.

The PC Labs tests proved no great challenge for the OkiLaser. It zipped through the graphics speed test, producing 1.2 gppm under its Hewlett-Packard LaserJet Series II emulation. The LED array in the OkiElectric engine produced crisp images with solid blacks and distinct grays. And the 400 produced text at its rated 4 ppm.

The OkiLaser sailed through the PCL torture test, accepting downloaded font definitions and macros with ease. It stumbled only when asked to produce IBM high-order characters. Instead, it defaulted to Roman. It took no more than a short control code to switch over to the high-order characters.

If you dislike using control codes, the front control panel, with its 16-character LCD window, will guide you through a variety of setup selections, including font and symbol set choices. Options can be mixed and matched through hierarchical menu displays that are activated by the panel's membrane buttons. There's even a labeled form-feed button for ejecting that last printed sheet left in the buffer if your software isn't quite up to HP requirements.

Given that the price gap between the 4-ppm OkiLaser and some 6-ppm printers is fairly close, you may initially opt for speed. Keep in mind, however, that the 400's internal fonts save the cost of six font cartridges, and its text throughput rate is typically very close to the actual speed of printers rated at 6 ppm. Consider the superb quality of its text and graphics output and the OkiLaser is an excellent choice.

IBM's new $1,495 5-ppm LaserPrinter E promises to give the HP IIP a run for its money. A $499 option turns the LaserPrinter E into one of the most affordable PostScript printers around.

better. Although it's slower in non-PostScript text modes, when it comes to graphics and PostScript text, the two printers perform identically—with up to 2MB installed. While the LaserPrinter E promises to gobble a big portion of the low-end laser market, it also promises to leave the more expensive LaserPrinter with barely a nibble. ■

List Price: IBM LaserPrinter E, $1,495; optional paper cassette attachment, $59; legal-size attachment, $69; optional envelope feeder, $329; upgrade to 1MB RAM, $449; upgrade to 2MB, $899; upgrade to 3.5MB, $1,599; upgradable DRAM memory, $1,599; downloadable font packages, $199; 128K font card, $142; 256K font card, $245; optional print cartridge, $199; PostScript option, $499; Premium PostScript option, $899; upgrade to 10 ppm, $1,099; printer-sharing option, $489. IBM Corp. (contact your local authorized IBM dealer); (800) IBM-2468 ext. 130.

CIRCLE 631 ON READER SERVICE CARD

FACT FILE

EDITOR'S CHOICE

Okidata OkiLaser 400
Okidata, 532 Fellowship Rd., Mt. Laurel, NJ 08054; (800) OKI-DATA, (609) 235-2600.
List Price: $1,395; variable-size paper trays, $89; upgrade to 1.5MB, $495; upgrade to 2.5MB, $940; font cartridges, $195.
Standard Warranty: 1 year parts and labor, dealer or depot service.
Dimensions (HWD): 5.25 x 17.5 x 22.5 in.
Weight: 24 lbs.
Emulations: Hewlett-Packard LaserJet Series II.
In Short: With excellent graphics and text output and the equivalent of six HP font cartridges built in, the 4-ppm OkiLaser 400 is an outstanding printer.

CIRCLE 408 ON READER SERVICE CARD

Qume CrystalPrint Series II

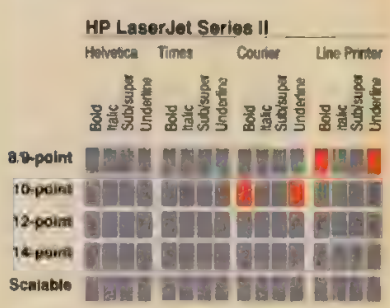
by Bill O'Brien

When we first reviewed the CrystalPrint Series II in our 1988 printer blockbuster ("Laser Printers: Another Year Older, Another Year Wiser," October 31, 1988), we noted that although the machine had some drawbacks, its bargain price made it a strong competitor. Nineteen months later and $500 cheaper, the veteran $1,499 CrystalPrint Series II now competes directly with the newer, almost identically priced HP LaserJet IIP and comes up a bit short.

Based on the Casio LCS-130 liquid crystal shutter printer engine, the 9- by 15.5- by 13.5-inch (HWD) CrystalPrint

Qume CrystalPrint Series II

Fonts & Features



Qume offers proprietary font cartridges and a PostScript upgrade. The printer accepts HP soft fonts.

New R:BASE® 3.0—the database that starts where your spreadsheet stops.

Spreadsheets are great for forecasting and planning, but frustrating if you need to manage a lot of data that changes on a regular basis. If you're a spreadsheet user, or if you've ever tried to learn a DBMS and given up, your time has come. Try new R:BASE 3.0. It will change the way you think about databases — forever.

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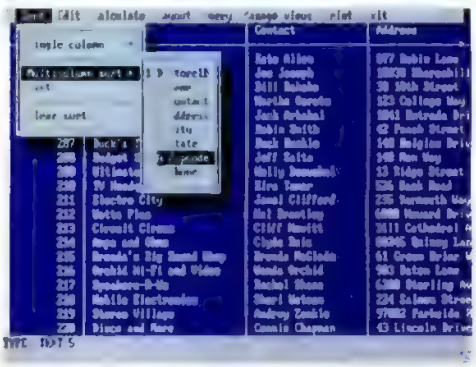

R:BASE 3.0 allows you to look at, edit and ask questions of your data from a single menu. Order your columns with a simple check of a box. And work with your data in a spreadsheet-like layout.

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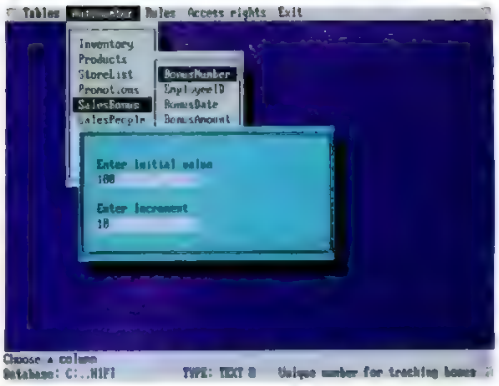
Discover R:BASE 3.0 the easy way. Try R:BASE 3.0 firsthand with the R:BASE 3.0 Sampler—just $9.95. For details call **1-800-248-2001, ext. A11.** Offer expires August 1, 1990.

Risk-free purchase. We're so sure you'll like R:BASE 3.0 that we're offering a no-questions-asked, 90-day money-back guarantee.

Attention: Unregistered R:BASE users! For a limited time, you can get a registered copy of new R:BASE 3.0 for the same low discounted upgrade price as registered users. Take advantage of this special one-time offer. Call 1-800-248-2001 for your nearest dealer.



Forget about tedious manual numbering of orders, ID numbers, or invoice numbers. R:BASE 3.0 not only numbers records in any increment you want, automatically, it's the only major DBMS that does it without programming.

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CIRCLE 539 ON READER SERVICE CARD

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Series II offers HP LaserJet Series II emulation at a rated 6 ppm with any of the standard Series II fonts: Courier, Courier Bold, and Line Printer. The base machine comes with 512K memory.

Setup is simple, but installation relies heavily on single-sheet documentation. Without referring to these loose pages, you may neglect to remove the two shipping spacers on the fuser roller. Do that and your printing will rub off the page because the toner wasn't fused to the paper.

These are not the only unfortunate documentation omissions: references to paper handling include only the correct method of loading the 100-sheet cassette and refer to an appendix that merely mentions that the CrystalPrint prefers 20-pound paper. Actually, the auto-feed will handle 16- to 22-pound letter or legal-size sheets. But because of the complex S-shaped paper path, the lack of a manual feeder for heavier or lighter stock was probably wise.

Qume has foregone the more common LCD display in favor of LED indicators. Ready, Power, Online, and Data Transfer functions are each signified by individual LEDs. The control panel's status display is equipped with two numeric LEDs that produce cryptic two-character error or status messages—an outdated throwback in these days of 16-character LCD readouts.

FACT FILE

Qume CrystalPrint Series II
Qume Corp., 500 Yosemite Dr., Milpitas, CA 95035; (408) 942-4000
List Price: $1,499; upgrade to 1.5MB RAM, $399, font cartridges, $139 to $279; optional paper tray, $69; PostScript upgrade, $2,999; Epson FX, Diablo 630, IBM Proprinter, or HPGL emulation cartridge, $139.
Standard Warranty: 90-day on-site or 12-month depot, owner selectable.
Dimensions (HWD): 9 x 15.75 x 13.5 in.
Weight: 32 lbs.
Emulations: HP LaserJet Series II.
In Short: The CrystalPrint II's low paper capacity and poor user-control panel are out of step with current trends. However, the optional emulation cartridges and its toner reclamation system may increase the CrystalPrint's attractiveness.

CIRCLE 409 ON READER SERVICE CARD

Optional accessories include a $399 1MB memory upgrade to reach the printer's 1.5MB maximum, and Qume's $139 to $279 proprietary font cartridges that simulate HP font equivalents. A user-installable PostScript upgrade is available for $2,999. Epson and Diablo emulation cartridges are available as well.

These complaints aside, the printer's output has much to recommend it. PC Labs' PCL torture test was no challenge for the CrystalPrint Series II. It accepted the soft font format of the downloaded PC Labs logo, correctly applied the graphic primitives, and responded to macro commands without so much as a sputter. Its graphics speed test results were outstanding at 1.7 gppm; and it produced text at 5.8 ppm—just under its rated speed—on our text speed test.

The torture test was no challenge for the Qume; its graphics speed was outstanding.

The printer sports an excellent toner reclamation system. Although it's a simple catch-bottle design, it does show concern for the environment and the lungs of users. Qume also offers an extraordinary 90-day on-site service warranty, or a 12-month depot warranty.

Because of its high-quality output and excellent warranty, a very competitive street price could make this a reasonable choice for a backup or low-volume printer. But if you're looking for a variety of paper-feed options, a user-friendly menu system, and a lot of built-in fonts, you'll have to look elsewhere.

Toshiba PageLaser6

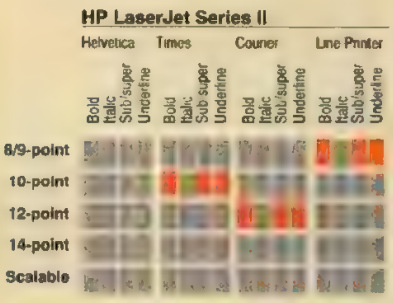
by Bill O'Brien

Long a bastion of portable computers and dot matrix printers, Toshiba has lately ventured into other sections of the personal computer market. Most recently, the Toshiba name appears on the company's PageLaser6, a 6-ppm laser printer that houses a TEC engine in an 8.5- by 24.25- by 14.5-inch (HWD) enclosure. Toshiba's low-end laser is virtually identical to the Epson and Facit TEC-based units reviewed here. At $1,549, the PageLaser6 is among the more costly of these low-end laser printers, but keep in mind that the price does include both Hewlett-Packard LaserJet Series II and IBM Proprinter XL emulations.

Installing the separate toner and photoconductor cartridges in the TEC engine is not difficult, though not as smooth as all-in-one cartridges. Toshiba has done a superlative job of documenting and illustrating the steps for the first-time buyer. The PageLaser6 uses a single 150-sheet-capacity paper bin. For paper below 16 and above 27 pounds, you can use the PageLaser6's manual-feed slot. Business-size envelopes are accommodated as well, and you can switch-select between faceup or facedown exit orientation for the printed sheets. The side tray, which doubles as a straight-through paper path, adds 11 inches to the printer's width, and Toshiba has also incorporated a fold-up tray design for this reason.

Toshiba PageLaser6

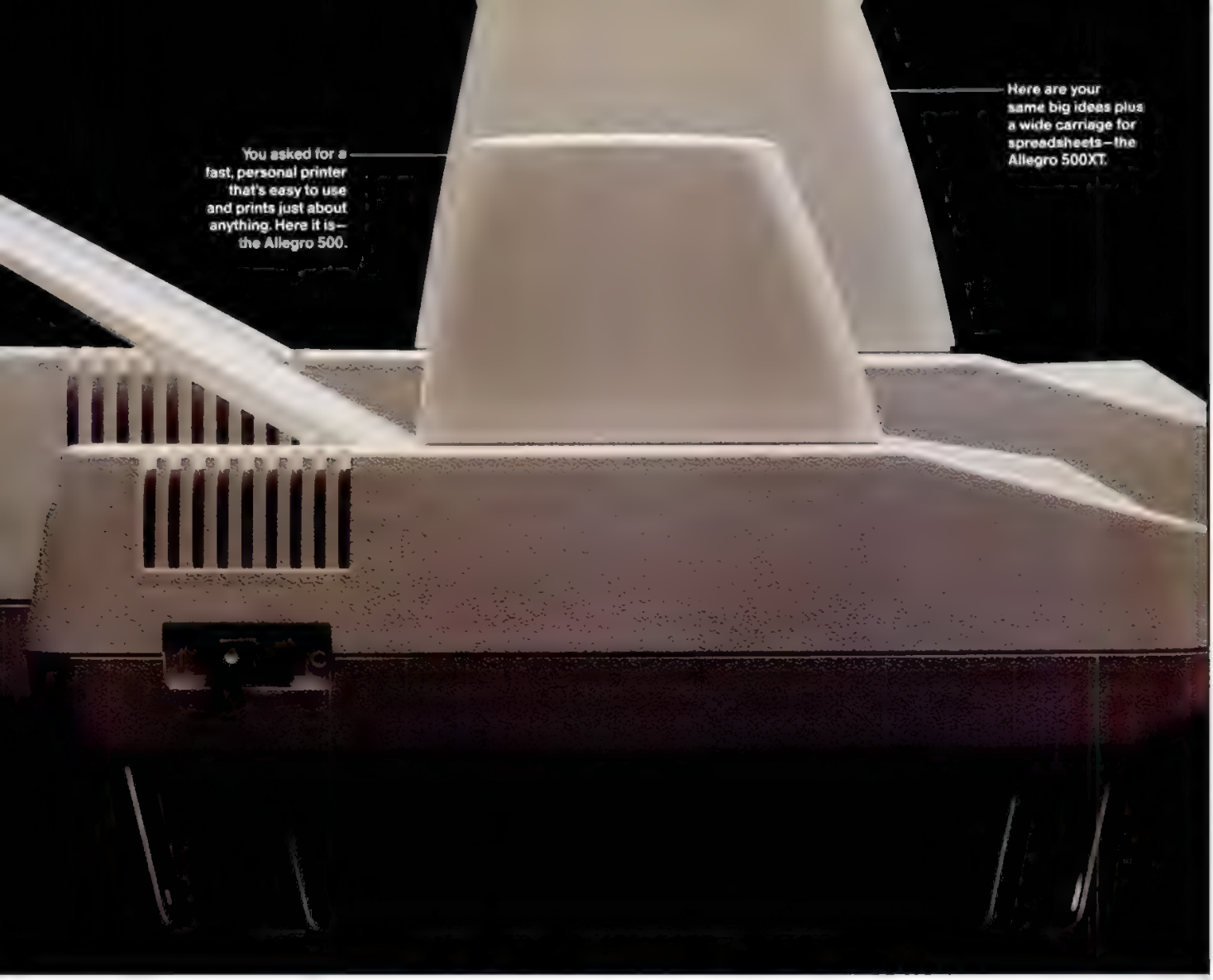
Fonts & Features



The PageLaser6 accepts HP cartridges and soft fonts. Its IBM Proprinter XL emulation is a welcomed addition.

Officially, the PageLaser6 stays strictly within the bounds of its dual emulations, providing Courier, Courier Bold, and Line Printer fonts to satisfy its HP emulation, and Prestige for its IBM Proprinter emulation. In actuality, there are 16 fonts resident in the printer. Each of the four main fonts comes in four versions that include a variety of symbol sets and foreign language characters.

Like other low-cost laser printers, the PageLaser6's control panel includes a 16-



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CIRCLE 242 ON READER SERVICE CARD

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3. Top-tier Performance. With its high-speed memory cache and Landmark** rating of 23.1, the Premium 386SX is faster than other name-brand SX machines on the market. It's even faster than our Bravo/386SX. If you're interested in speed, this is the machine for you.

4. An Award-Winning System. The Premium 386SX is one of the most highly praised computers today. It won PC Magazine's Editor's Choice award. It outranked Compaq's SX in an InfoWorld report. It even garnered praise from the German Publication, Persönnel Computerlich, as the "Very Best" SX computer.

PC MAGAZINE EDITOR'S CHOICE

5. Rich With Features. Standard VGA graphics; a wealth of drive bays and expansion slots; support for up to three floppy drives; password security and one parallel and two serial ports.

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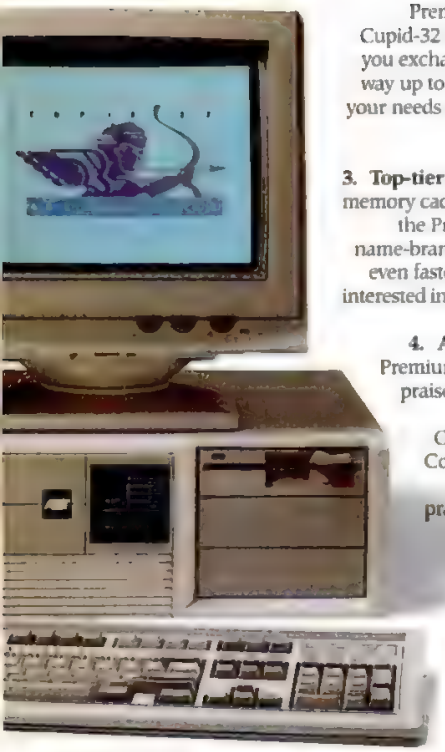

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4. No Extra Cost For Extra Features. Bravo/386SX comes standard with the features you need. Bright VGA graphics and 2 MB of fast paged-mode RAM don't cost you extra, but they sure put an extra level of power at your fingertips.

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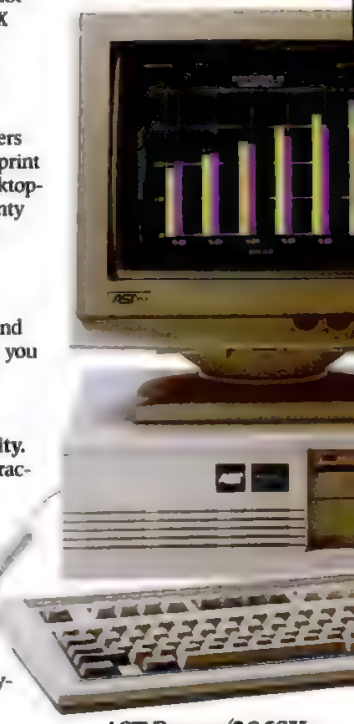
See these two computers for yourself. For the name of the AST dealer nearest you, call **1-800-876-4AST**. You can also use our electronic On-Line Technical Information Network at **(714) 727-4723**.



AST Bravo/386SX.
Starting at **$2095.**

*List prices are MSRP — 4 1 90. **Speed tests based upon Landmark Software version 1 10 benchmarks — a generalized index used to compare machines. The higher the number the better. ***Computer Reseller News, March 26, 1990. Source — Storeboard, Inc AST markets products worldwide — Corporate Headquarters: P O Box 19658, Irvine, CA 92713-9658 (714) 727-9292, in Europe and the Middle East call 44 1 568 4350; in Japan call 81 3 818 0710; in the Far East call our Hong Kong office at 852 5 806 4333; in Canada call 416-826-7514, in Australia call 61 2 906 2200. AST is a supplier to U.S. government agencies, General Service Contract number GSOOK89AGS6418. AST, AST logo and AST Premium registered and Cupid-32 and Cupid logo trademarks AST Research, Inc. All other product or brand names are trademarks or registered trademarks of their respective companies. Copyright 1990 AST Research, Inc. All rights reserved

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CIRCLE 166 ON READER SERVICE CARD

character LCD readout. The panel's eight membrane buttons can be used to access the hierarchical setup menus—saving you the hassle of printer control codes. The panel is also used to select one of the two interface types (parallel or serial), the paper-handling mode, and the myriad of other printer setup options. As with all TEC-based printers, the Reset/Continue button also functions as an unlabeled form-feed control.

The PageLaser6 handled PC Labs'

Toshiba PageLaser6
Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (800) 334-3445.
List Price: $1,549, optional paper tray, $39; upgrade to 1.5MB, $499; upgrade to 2.5MB, $999; upgrade to 4.5MB, $1,999
Standard Warranty: 1 year from date of purchase, dealer or depot service.
Dimensions (HWD): 8.5 x 24.25 x 14.5 in.
Weight: 35 lbs.
Emulations: HP LaserJet Series II, IBM Proprinter XL.
In Short: Virtually identical to the other TEC-based printers reviewed here—the Epson and Facit—the PageLaser6 is a credible performer with an outstanding manual and an added bonus of Proprinter XL emulation.

CIRCLE 410 ON READER SERVICE CARD

printer tests with ease. It gobbled up the PCL torture test, printing the downloaded PC Labs logo correctly and following macro commands unflinchingly. The output from both text and graphics tests looked good, although some ghosting appeared in early versions of the graphics test. The PageLaser6 produced graphic images at 1.1 gppm. Text printing speed was acceptable at 5.7 ppm in HP mode and slightly slower in IBM Proprinter XL emulation.

The added versatility of the IBM emulation is what makes the PageLaser6 a credible choice among our low-cost group. When tied to its HP soft font and font cartridge compatibility, that's the edge that makes it a good value. ■

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▪ ***"PERFECT":*** *The* cartridge for WordPerfect® 5.0/5.1. Century (like Schoolbook) and Swiss (like Helvetica) 6 to 30 point. For all HP. $349.

▪ ***PRO-IIP:*** Mix of fixed pitch and proportional. Century, Swiss, Letter Gothic, Presentation and Prestige. Six to 30 point. Ideal for HP IIP, IID and III. $249.

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CIRCLE 125 ON READER SERVICE CARD

PC Magazine says, "Northgate's™ SlimLine™ 320 ..

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PC Magazine said: "(SlimLine) doesn't take up a lot of room...but it delivers plenty of computer for a price you might expect to pay for a 286 system."

The heart of the system is a new Northgate proprietary motherboard with built-in hard and floppy disk controllers, 2 serial and 1 parallel port and 16-bit VGA video. Smaller than a sheet of legal paper. It gives you a host of features that are add-ons in others' systems. Even our clock/calendar method is guaranteed for 5 years without using old-fashioned batteries. And with five expansion slots, you have plenty of room for all your peripherals.

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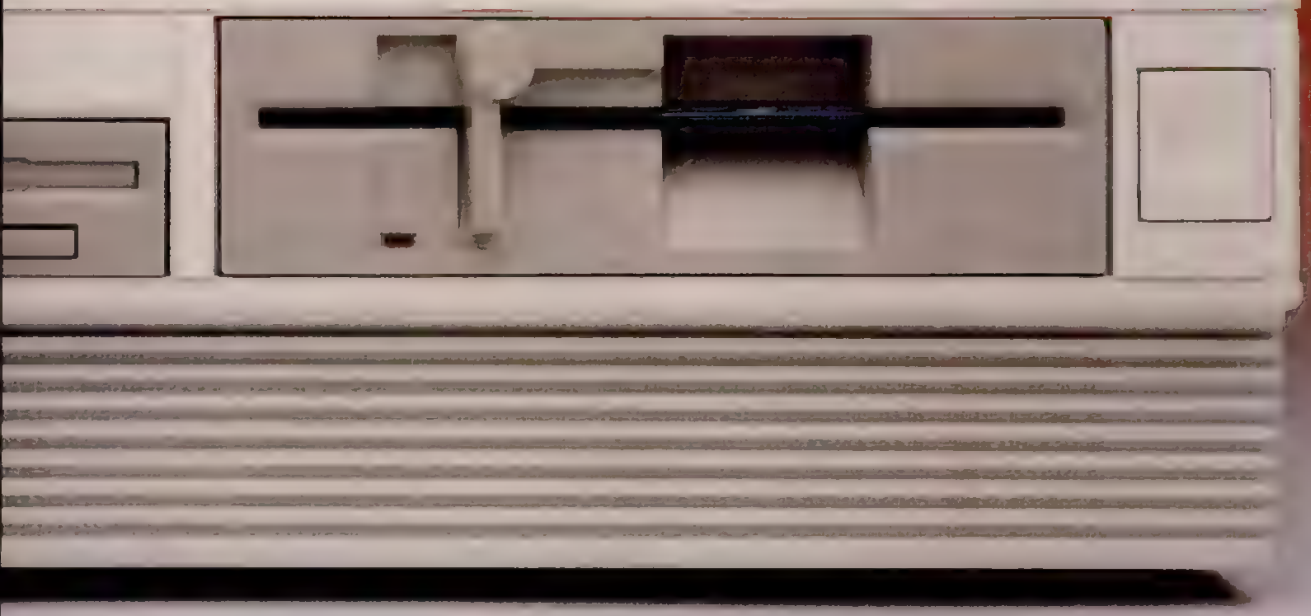
When it's this good, this cheap, why buy less?"*

December 26, 1989



And remember... your Northgate SlimLine 320 is backed by expert technical support any time you need it. Call toll-free, 7 days a week, 24 hours a day. On-site deskside service is available 5 days a week (to most locations) if we can't solve your problem over the phone.

SYSTEM FEATURES

- Intel 80386-20MHz microprocessor
- 2Mb of RAM; expandable to 8Mb on motherboard
- 40Mb hard drive with 28ms access time
- 3.25" 1.44Mb and 5.5" 1.2Mb Floppy Disks (reads, writes and formats low density diskettes)
- Page mode memory system
- Integrated high performance 16-bit VGA color controller with 256K video RAM supporting 800x600 line resolution
- Integrated high performance floppy and hard disk controller on the motherboard
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But we can't tell you that what you need is the compact size (and compact price!) of the 4-page-per-minute LBP®-4. You're the only one who knows how convenient its 14" x 16" size and quiet operation would be on *your* home or office desktop. And how can we even guess what you'd do with the standard video interface for fast, high-resolution applications?

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Maybe you never need to print letterhead plus second sheets, or long unattended jobs. So why should we brag about the Mark IIIT,™ with dual paper cassettes that can hold up to 400 sheets? Just because it can combine portrait and landscape text? Big deal—that's standard for Canon Laser Beam Printers.

And unless you want the ultimate in capability and convenience, you'd have no interest in the Mark IIIR,™ with dual cassettes and duplex printing for newsletters, and lengthy reports. Even though, like the others (yawn), it supports all popular word-processing and DTP software.

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CIRCLE 471 ON READER SERVICE CARD

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CACHING CONTROLLERS:

Hard Disk Access In No Time Flat

Caching disk controllers promise to boost your system's performance dramatically. But with price tags as high as $1,800, you may wonder if you'd be better off with a $100 software alternative.

ILLUSTRATION: DOUG ARCHER

by Alfred Poor

I'll never forget the first time I encountered a caching disk controller. I was in PC Labs putting some hot new PC-compatible system through its paces with our benchmark tests, when I looked at the DOS file speed and did a double take. Either there was some phenomenal bug in the test programs or there was something special under the hood of this beast. It turned out to be a caching disk controller, quietly blasting past performance marks and making file-speed history.

Since that first exposure, I have seen caching disk controllers become more common, especially among high-end system configurations that are destined for demanding ap-

plications such as a network file server or a multiuser host. These cards cost more than traditional hard disk controllers, so the questions that naturally arise are: What does a caching disk controller do, and are the benefits worth the extra cost?

The answer to the first question gets a little technical, but the fundamental concept is quite simple. Silicon is faster than iron. In other words, it's faster to read or write to memory chips than it is to perform the same tasks with magnetic media. Hard disk designs have a limit of about 12 milliseconds for average seek time—far slower than the time required to access data in memory. A caching disk controller is able to use the speed of on-board memory chips to provide much faster access to data stored on the hard disk.

DO-IT-YOURSELF DISK CACHING

This comes as no surprise to power users who have been taking advantage of RAM speed well before there were caching disk controllers. For example, my brother could probably win an award for having one of the longest boot-up configurations in the world. His system sets up a RAM disk (a device that sets aside a portion of memory that the system treats as if it were a logical disk drive) and then automatically copies all the programs and data files he uses the most onto this drive. Then, when he needs to call his favorite text editor or any of a dozen utility programs, they're already waiting on the fast RAM disk.

Disk caching accomplishes the same result as my brother's huge AUTOEXEC .BAT procedure, but with added benefits. The cache is filled with programs and data as they are called for during a session. Consequently, you don't have to design a configuration that determines which information will be loaded in the cache. The cache can also store frequently used information that does not exist in DOS files; disk directory and FAT (file allocation table) data can also be stored in a cache, so subsequent disk accesses are made faster. After data is in the cache, it can be used again directly from DRAM without making the disk controller go back to the drive to read it.

Once the cache is filled, it's clever enough to know which information was least used, and it throws that away in order to make space for new information as it's read from the disk. Controller manufacturers work hard to develop effective algorithms to get rid of Least Recently Used (LRU) data and retain Most Recently Used (MRU) information in order to improve cache performance.

LOOKING AHEAD

Disk caching adds another significant benefit. When the CPU calls for data from a given disk sector, a normal system just reads that one sector and returns the data to the CPU. DOS organizes its information sequentially, however, and this presents an opportunity for a cache to create significant performance gains. Instead of reading just a single sector, it will read the requested one as well as a number of the following sectors. The assumption being that the CPU will request the adjacent data next. If the guess is correct, the result will be a "cache hit"—meaning that the data is already in the cache and no additional disk access is required (see the sidebar "How a Disk Cache Works").

> By looking ahead and managing current data, caches create dramatic performance gains.

This ability to look ahead and manage data already in the cache can result in some impressive performance gains—though not quite as high as the 90 percent cache hit rate claimed by some vendors. PC Labs' tests indicate that caching disk controllers make many disk operations run two to ten times as fast as conventional hard disk controllers do—an important boost for many applications.

Warning: Don't confuse disk caching with memory caching. The latter is implemented in many 386 systems. Using small banks of high-speed static RAM, memory caching eliminates most memory wait states, thereby improving overall system performance. The main difference between memory caching and disk caching is that the first speeds access to system memory, while the second improves access to disk storage. The good news is that the two are not mutually exclusive: you can choose or put together a system with both.

Be aware that some manufacturers describe their controllers as having a "read-ahead cache" on the board. This feature reads adjacent sectors like the more-sophisticated caching controllers, but is unable to intelligently manage the data it has read. These cards might best be described as buffered controllers, rather than caching cards, since they provide a benefit similar to the DOS BUFFERS command. Or there are products such as the DiskMaster, from Cogent Data Technologies ((206) 378-2929), which does bus mastering, fast data transfers, and hard disk mirroring but doesn't perform caching.

CONTROLLING THE CACHE

The benefits of disk caching are clear, but it's not so clear how best to achieve them. There are two basic designs: the caching disk controller, which takes a hardware approach, and the disk caching program, which is a software solution (see the sidebar "Data on the Fast Track: Disk Caching Approaches").

In this article, we're focusing on the hardware approach. To be included here, each product had to run under DOS with ESDI disk drives, support a minimum of 256K cache memory, and fit in a standard AT-style ISA 16-bit expansion slot. Four caching disk controllers met our requirements: the CompuAdd HardCache/ESDI, the DPT SmartCache Controller model PM3011/75, the Konan TenTime TNT-2210, and Perceptive Solutions' hyperSTORE-1600.

These caching disk controllers replace the traditional disk controller. The major difference is that they contain CPU chips of their own, along with a sizable hunk of memory. Early designs came configured with as little as 128K of memory on-board, but as memory chip prices plummeted, installed RAM rose. Most caching controllers now come with a minimum of 512K, although one unit reviewed here, the Konan TenTime, has a full 2MB installed in the base model.

The memory is managed by the card's own processor. This can range from an 8-bit V20 chip to a 32-bit 68000. That means you could end up with a disk controller as powerful as the computer in which it's installed. This "brains on board" design is a common development in current computer architecture, as graphics adapters and printer interfaces frequently sport their own private processors. The idea behind these extra brains is to relieve the burden on the computer's CPU so that it can devote its full efforts toward executing program instructions.

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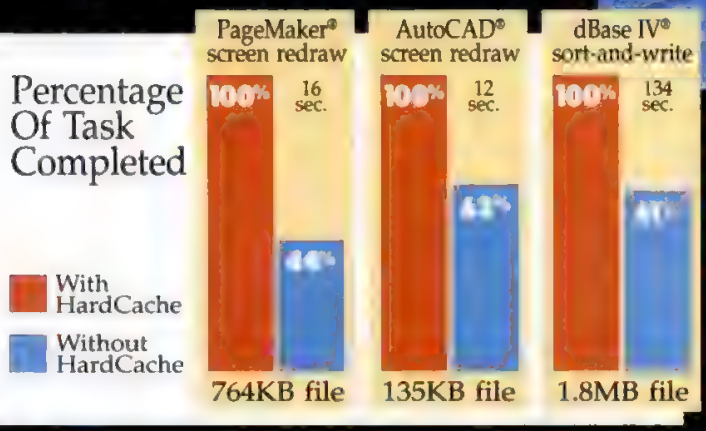

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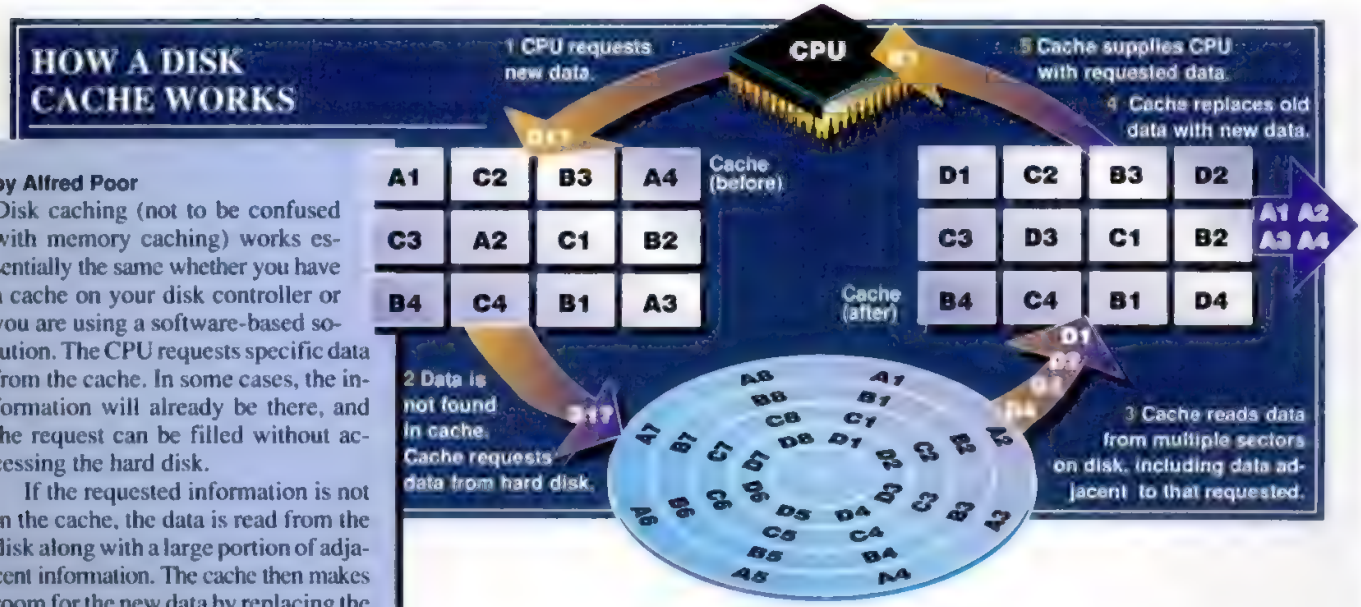

by Alfred Poor

Disk caching (not to be confused with memory caching) works essentially the same whether you have a cache on your disk controller or you are using a software-based solution. The CPU requests specific data from the cache. In some cases, the information will already be there, and the request can be filled without accessing the hard disk.

If the requested information is not in the cache, the data is read from the disk along with a large portion of adjacent information. The cache then makes room for the new data by replacing the old. Depending on the algorithm, this may be the cache's oldest (first loaded) or the least-used information. The CPU's request can then be filled, and the cache already has the adjacent data loaded in anticipation of that information being requested next.

However, the hardware design has a problem in that a caching disk controller must plug into the computer's bus. The controllers we looked at must send their data to the CPU through the slower traditional AT-bus, which has a bandwidth of 16-bits and runs at only 8 MHz. In 32-bit controllers—such as the Compaq Systempro's EISA-bus IDA (Intelligent Drive Array) and the Intel AT-bus Mylex DC376—the bus is less of a limitation.

SOFTWARE SOLUTIONS

The alternative design for a cache is to use software that sets aside a section of extra memory, either expanded or extended, for use as a disk cache. This functions the same way as the caching disk controller, except for two differences. On the downside, it requires the system CPU to handle all the cache management tasks, adding to the processor's burden and slowing its performance. On the other hand, if the memory in use is located on the motherboard, it's not restricted by slow bus speeds. If the system is a 386, then the program's cache will also be able to transfer its data using the 32-bit-wide data path, which means even better response.

Note: some disk caching programs can make use of memory located in the computer's lower 640K. These options are not practical today for a number of reasons. First, the demands made on the 640K DOS system memory are constantly growing, because of larger operating systems, more TSRs and device drivers, and bigger application programs. Even without the problems of "RAM cram," the bigger your disk cache, the better. You need at least 512K to get significant gains, and in many systems 2MB would be a good place to start. This can only be achieved using expanded or extended memory, or by adding a caching disk controller with its own separate memory on-board.

PC Labs' test results indicate that performance suffers as soon as you go outside the bounds of the cache—that is, as soon as your files are larger than the size of your cache. The best way you can improve your hard disk performance is to buy more memory—more system memory if you're using a software alternative, more RAM cache if you're using a hardware product.

CHOOSING YOUR CACHE

How do you know if you need a disk cache at all? And if you do need one, which approach should you take?

The first question is relatively easy to answer. Watch the hard disk access light on your computer while you work. If it spends most of its time flashing or glowing steadily, you need a cache. If there are occasions when you have to sit and wait while it flashes or glows steadily, you'll probably benefit from a cache, but not for certain.

Database applications and data-intensive programs such as desktop publishing, CAD, or graphics all typically require frequent and extensive access to hard disk data. If you "live" in one of these programs, a cache will probably help. If you work primarily with word processing or spreadsheet programs—applications that typically hold all their data in the computer's memory when in use—you're probably already getting most of the benefits a cache can offer since the only disk accesses usually required occur when you load or save a file. The exception is when you're constantly jumping back and forth between two or more applications; in this case, a cache should make loading the applications faster when it comes time to switch.

HARDWARE VS. SOFTWARE

If you have determined that a cache should help, the next decision is whether to choose a hardware or software solution. One consideration is cost. The four controllers reviewed here carry list prices ranging from $700 to $1,800 with 2MB—our configuration as tested. Assuming that you don't have to replace your hard disk to go with the new controller, this is still a hefty tab. Software-based solutions such as Multisoft Corp.'s *Super PC-Kwik* ((503) 644-5644) and Software Masters' *Flash* ((317) 253-8088) carry list prices under $100 for standalone products, and many "Swiss Army" utilities, such as Central Point Software's *PC Tools* ((503) 690-8090), include a disk caching feature.

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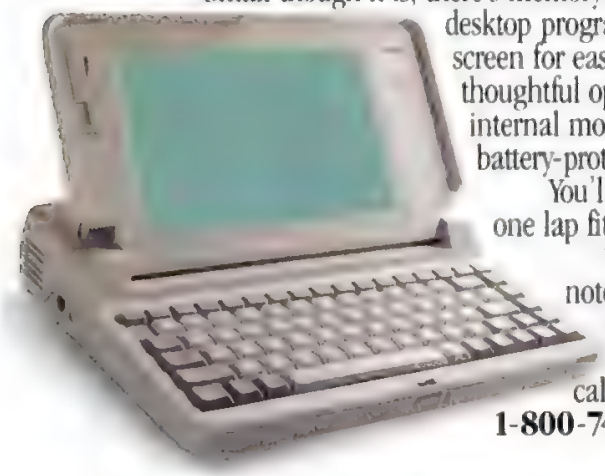

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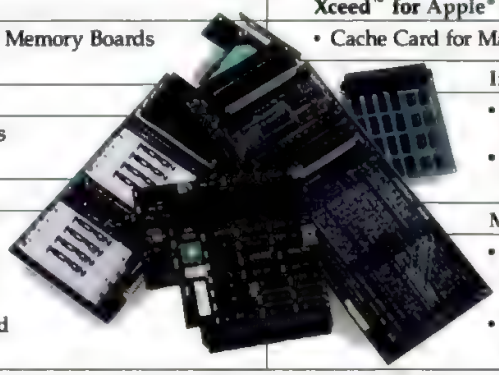

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EDITOR'S CHOICE

- DPT SmartCache PM3011/75
- Software caching program

The four caching disk controllers we reviewed, priced between $700 and $1,800, all markedly improve hard disk access. But so do software caching programs, which cost hundreds of dollars less and deliver performance that equals or even exceeds that of the controllers.

Therefore, for single-user systems running DOS (including PCs used as workstations on a LAN), we recommend that you buy an extra 2MB of system memory and a good caching software program—a combination that should cost you well under $500. The best software performers, Multisoft Corp.'s *Super PC-Kwik* and Software Masters' *Flash*, carry list prices under $100. You also might want to consider even less-expensive caching programs, such as the CACHE.EXE device driver, which comes with Compaq's PCs and is included in the performance tests in this story; utilities, such as Central Point Software's *PC Tools*, which includes a caching feature; and public domain and shareware caching programs, which you can download from bulletin boards (such as *DCACHE.COM* from PC MagNet on CompuServe). For more information on caching programs, see "Getting the Most Out of Memory," *PC Magazine*, February 14, 1989.

Although caching programs are best for boosting hard disk performance in single-user DOS systems, disk caching controllers are not without their place. Especially consider them for use on file servers and in non-DOS environments such as Unix and Novell *NetWare*, where they provide a wise upgrade to older, traffic-laden file servers. Based on PC Labs' performance tests, the controller that will most improve your hard disk's performance is the DPT SmartCache. With fast results and consistent performance over a range of file sizes, it set the standard for the other controllers.

If it's a bargain you're after, the CompuAdd HardCache/ESDI comes in as the low-cost leader. At a base price of $495, it comes with 256K of cache memory; however, you really should equip it with at least 2MB—as you should with any of these products. At $705 with 2MB, it's still the cheapest of the four ESDI controllers, especially since you can use standard, readily available SIMM modules. (PSI's hyperSTORE-1600 supports these modules, as well.)

Although CompuAdd's data-read performance is equivalent to the other three, its write performance is no faster than an uncached controller because of CompuAdd's conservative design. Because the HardCache doesn't cache writes, your data won't be lost or corrupted if the power goes out or the system fails—that's an advantage.

By simply plugging in an interface daughterboard, the Perceptive Solutions hyperSTORE-1600 can be used with any high-performance disk interface on the market today. And, because the caching algorithm resides in software, upgrading is convenient. Consider PSI if you value flexibility.

Realizing that performance is largely based on cache size, Konan now makes its ESDI board standard with a 2MB RAM cache, while maintaining a reasonable price. It, too, wasn't a standout performer, but PC Labs' tests determined, the four boards performed similarly.

Which cache should you buy? DOS-based PCs will gain the best performance from the cheapest solution: a software caching program and 2MB of dedicated memory. For file servers and non-DOS PCs, look first to the DPT SmartCache. Although the performance difference was small, DPT's margin remained consistent throughout the testing.

Finally, whichever caching method you choose, buy one with as much memory—system memory for software, RAM cache for hardware—as you can afford. PC Labs' test results show that the increased performance of a cache is consistent across files that are smaller than the cache. Once outside the cache boundaries, however, performance suffers dramatically. So buy as much memory as you can.

There are even public domain and shareware cache programs you can download from various bulletin boards (*DCACHE.COM*, which you can obtain from PC MagNet on CompuServe, is just one available choice). The difference in price from the hardware approach leaves you plenty of money to purchase extended or expanded memory.

In PC Labs' tests, caching programs were able to match, and in many cases exceed, the performance of the caching disk controllers. This indicates that for most standalone, single-user DOS applications, you will probably find better value with a software solution. (For more information on caching programs, see "Getting the Most Out of Memory," *PC Magazine*, February 14, 1989.)

There are two classes of applications that make special demands on the CPU: multitasking and multiuser. In both cases, the CPU may well have its hands full with managing tasks other than disk access. As a result, disk caching controllers may be best suited for use in servers for local area networks or Unix systems. In fact, Consensys Corp. ((800) 387-8951) makes a caching controller designed specifically for Unix, the $995 Powerstor (not reviewed here).

Some computer manufacturers are now building advanced disk controllers that are key components in their top-end server systems. These new products are not tested here because they're not ISA-bus cards, but they are important, as they may point toward the future for disk controllers in general.

COMPAQ'S ALTERNATE SOLUTION

As previously mentioned, the Compaq Systempro is one of the hot new system designs, and IDA plays a big role in its impressive performance (see "The Best Computer $43,000 Can Buy," *PC Magazine*, April 10, 1990). The controller uses a 32-bit EISA-bus interface and can handle

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up to eight hard disks. It has an on-board 80186 processor and 128K of transfer memory to facilitate bus mastered transfers, but its performance features don't stop there. It's a bus mastering device, which means it has the ability to write data from the disk drive directly to the computer's memory without going through the CPU at all.

The Compaq IDA also handles its hard disks differently from most controllers. It uses a feature called "sector striping." It views as many as four separate hard disks as a single logical unit and can read or write to each drive simultaneously. Instead of writing consecutive sectors of data to a single disk drive, it spreads them over all available physical disks, thus reading or writing as many as four sectors at the same instant.

The Systempro includes a number of ways to safeguard data on the hard disks. One method is "mirroring," a feature offered as an $800 option on the DPT SmartCache and a $295 option on the PSI hyperSTORE-1600 (both reviewed here). Mirroring writes the same data simultaneously to two physical disk drives so that if one fails, the other contains all the information, and the system continues to run. Duplicating each disk can be an expensive proposition, however, so the IDA also uses "data guarding," which can protect data when multiple disks are used. A portion of each disk is set aside for a check-bit, and this information is calculated based on the data written at a given spot on all the other disks. If one disk should fail, the remaining disks can re-create the missing data by comparing the check-bit information.

ZENITH'S POSITION

Another new system, the Zenith Z-386/33E sports a disk controller design that promises improved disk performance. Built by Data Technology Corp. ((408) 262-7700), the card also uses the new EISA-bus design with its wider data path. The card uses an 8-bit V20 for its on-board controller and can be configured with 1MB to 4MB of memory. The card controls a pair of floppy disks, four ESDI drives, and up to seven SCSI devices daisy-chained to its SCSI port. One special feature is the use of "position sensing," in which the controller keeps track of how close the disk drive read/write heads are to the desired data in terms of track and sector. When you have multiple hard drives installed, position sensing allows the controller to decide which disk is going to provide needed information the fastest. DTC is planning to release its own version of this controller, which will run on ISA and EISA buses, but this version won't include the position sensing feature.

If—like most of us—you're running DOS on a standard ISA-bus computer, you're limited to the caching disk controller choices we cover in this review. Each of the four products offers a unique combination of features and flaws, making some better suited for some applications than others. Be sure to check the features table and the reviews to find the one that's best for you.

One fact is certain: when you first fire up a system with one of these caching disk controllers installed, you'll see blazing speed that you won't forget.

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CIRCLE 190 ON READER SERVICE CARD

COMPUADD CORP.

CompuAdd HardCache/ESDI

All reviews by Alfred Poor

CompuAdd has built a solid reputation as one of the leading mail-order vendors for PC-compatible computers. Recently, the company entered the caching disk controller market with a new product bound to make a splash. Their HardCache/ESDI controller carries an improbably low list price of $495 for the base model with 256K memory.

The price is startling in that it's less than half the price of competing cards. Even when configured with 2MB for our tests, the price is just $705. Keep in mind that you're not likely to find a lower "street" price on this one, since it is only available directly from the manufacturer. On the other hand, since it takes standard SIMMs, you can purchase memory from other sources and install it yourself. The card takes either 256K or 1MB modules; you cannot mix sizes, but you can install them one at a time. This gives you a configuration range of 256K to 4MB. Aside from additional memory, there are no options offered by CompuAdd for its controller.

The HardCache is a full-length card that requires a 16-bit slot, but its low profile is the same height as an XT expansion card, which means it can fit in compact cases where an AT-size card can't. Despite its smaller size, the layout is not cramped. The card uses a number of surface-mounted VLSI (very large scale integration) chips from Western Digital and Omti, with the SIMM mounts stacked in a compact group at the far end. The 10-MHz 80188 processor is a surface-mount design from Intel that saves even more space. The design is fairly clean, with only one stray wire added to the top. The card is also engineered to run at bus speeds as high as 12.5 MHz; with some PC compatibles you can increase the bus speed above the standard 8 MHz, which could yield even faster performance.

Installation is easy. The card supports both floppy and hard disk drives, and the connectors are clearly labeled right on the card. The ends of pin 1 are also marked right on the card, so you don't need to refer back and forth to the documentation when trying to figure out where the red stripe on the cable goes. The connectors are at the top center of the card, with plenty of space for the cables, which makes routing the wires simple.

The documentation is excellent. One of the hardest parts of installing most expansion cards is making sure that you get all the jumper settings correct, and CompuAdd makes it easy, with clear illustrations and straightforward instructions.

Before you can get your drive ready to run, you must change the CMOS configuration information so that your computer sees the disk as a type 1 drive, no matter what ESDI disk you have installed. After you make this change, you must reboot the computer and run the HardCache FMT utility. This is a menu-driven program that will perform a low-level format for the hard disk. You can choose either a straight format procedure or one that performs an extensive surface analysis at the same time. Surface analysis takes much longer, but ensures that bad spots on the disk are locked out.

After the disk has been given a low-level format, you partition the disk and format it with your usual DOS utilities. We had no problems using Compaq DOS 3.31, even when we created a single 300MB DOS partition.

The HardCache incorporates a fair amount of intelligence, including power-on self-test routines and dynamic configuration of the cache, up to eight-way set associative cache depending on the application requirements. There is one important feature that is not designed to improve the card's speed: the HardCache uses a "Write-Through" rather than the more common "Write-Back" algorithm. This means that all disk writes are executed right away, instead of being held in the cache for more efficient ordering and writing later. This approach is slower, but the advantage is that it's safer—you are less likely to lose data from a power loss or other failure since the information isn't held in volatile cache memory.

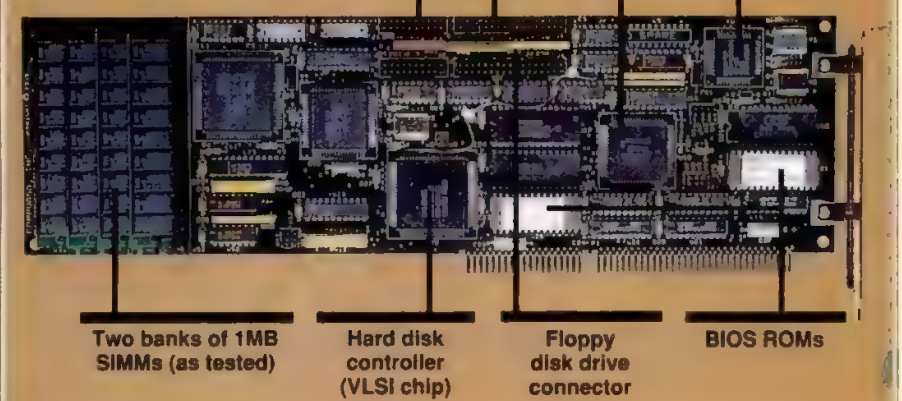
The difference in disk write design clearly shows in the performance results, with the HardCache turning in the slowest times for nearly every create or write test. (For the small record tests, though, it was still considerably faster on writes than the

FACT FILE

CompuAdd HardCache/ESDI
CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; (800) 666-1872, (512) 250-1489.
List Price: With 256K RAM, $495 (base price); with 2MB RAM, $705 (price as tested).
Requires: AT or compatible, ESDI hard disk, 16-bit slot.
In Short: The CompuAdd HardCache/ESDI sets an aggressive price for caching disk controllers and delivers excellent performance. Although slowed slightly by a conservative disk write design, its disk read times are among the best that we saw.

CIRCLE 630 ON READER SERVICE CARD

COMPUADD HARDCACHE/ESDI



Comprehensive features for greater productivity.

Many products claim to have a few XTree-like features. But there's really only one way to get the rich set of features found in XTreePro Gold.™ And there's only one way to receive the award-winning features and performance that made XTree® the industry standard.

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XTreePro Gold brings you an intuitive hard disk user environment. There's no need to memorize cumbersome DOS commands or file path names, because now you just point and click, or tap a single key if you prefer.

XTreePro Gold makes it easy to manage your hard disk and increase your productivity. Search multiple files by contents. Execute applications and associated data files. Copy or move a block of text between files. Even view files in the native formats of applications like dBASE, Lotus 1-2-3, Microsoft Word, WordPerfect and other popular word processing programs.

	XTREE PRO GOLD $129	NORTON COMMANDER 3.0 $149	LOTUS MAGELLAN $195	PC TOOLS $129
APPLICATION MENU	✓	✓	MACRO	✓
AUTO VIEW (BROWSE)	✓		✓	
FIND FILES	✓		✓	✓
COPY/MOVE FILE CONTENTS	✓		✓	
VIEW FILES	✓	✓	✓	✓
OPEN/ASSOCIATE APPLICATION	✓	✓	✓	✓
SPLIT WINDOWS	✓	✓	✓	✓
PRUNE/GRAFT	✓			
GLOBAL FILE VIEWS	✓			
COLLAPSE DIRECTORIES	✓			
HIDE/UNHIDE DIRECTORIES	✓			✓
FORMAT DISKS	✓			
TOGGLE/MERGE TAGGED FILES	✓			
REVERSE FILE SPECS	✓		✓	
COPY ORIGINAL DIRECTORY STRUCTURE	✓			
DATE/TIME STAMP FILES	✓			✓
PRINT DIRECTORY TREE	✓	✓		✓
CHANGE FILE ATTRIBUTES	✓			
RENAME A VOLUME	✓		✓	
ARCHIVE MANAGER	✓	✓	✓	✓
EGA/VGA SUPPORT	✓	✓	✓	✓
MOUSE SUPPORT	✓			

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CIRCLE 199 ON READER SERVICE CARD

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MCA 80386SX 16Mhz

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- 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- On-board VGA Controller
- Memory Management disk cache program software
- Five slots

Base system:	**$2,255**
40 MB VGA mono system	**$3,087**
40 MB VGA color system	**$3,417**
76 MB VGA mono system	**$3,561**
76 MB VGA color system	**$3,891**

Model AT316S-6
80386SX 16Mhz

- Industry Standard Architecture
- 1 MB RAM expandable to 8 MB on CPU Board
- 1.2 MB or 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- Integrated Floppy Controller
- Memory Management Software

Base system:	**$1,458**
40 MB VGA mono system	**$2,169**
40 MB VGA color system	**$2,499**
100 MB VGA mono system	**$2,586**
100 MB VGA color system	**$2,916**

Model AT216-6
80286 16Mhz

- Industry Standard Architecture
- 1 MB RAM expandable to 8 MB on CPU Board
- 1.2 MB or 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- Integrated Floppy Controller
- Memory Management Software

Base system:	**$1,263**
20 MB VGA mono system	**$1,863**
20 MB VGA color system	**$2,193**
40 MB VGA mono system	**$1,974**
40 MB VGA color system	**$2,304**

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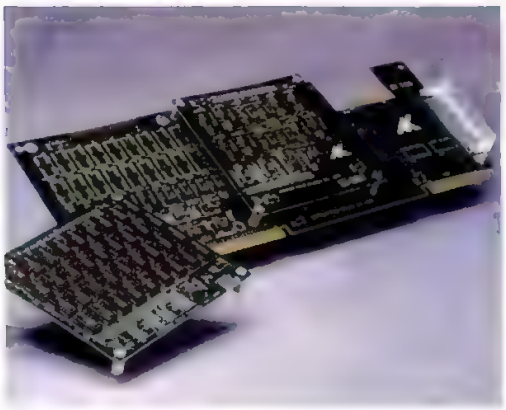

CIRCLE 202 ON READER SERVICE CARD

AMKLY™ Systems, Inc.

80 Technology Drive, Irvine, CA 92718 ■ (714) 727-0788

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standard Compaq controller.) On the sequential and random reads, however, it was almost always near the top speed compared with the other three boards.

The bottom line on the HardCache/ESDI is that it presents an outstanding value if you need an intelligent controller for an ESDI hard drive. It takes a conservative approach to managing disk writes, but since most applications do more reading than writing, it is likely that you won't notice the performance difference in the majority of cases. CompuAdd should have a true winner on its hands with this one.

DISTRIBUTED PROCESSING TECHNOLOGY

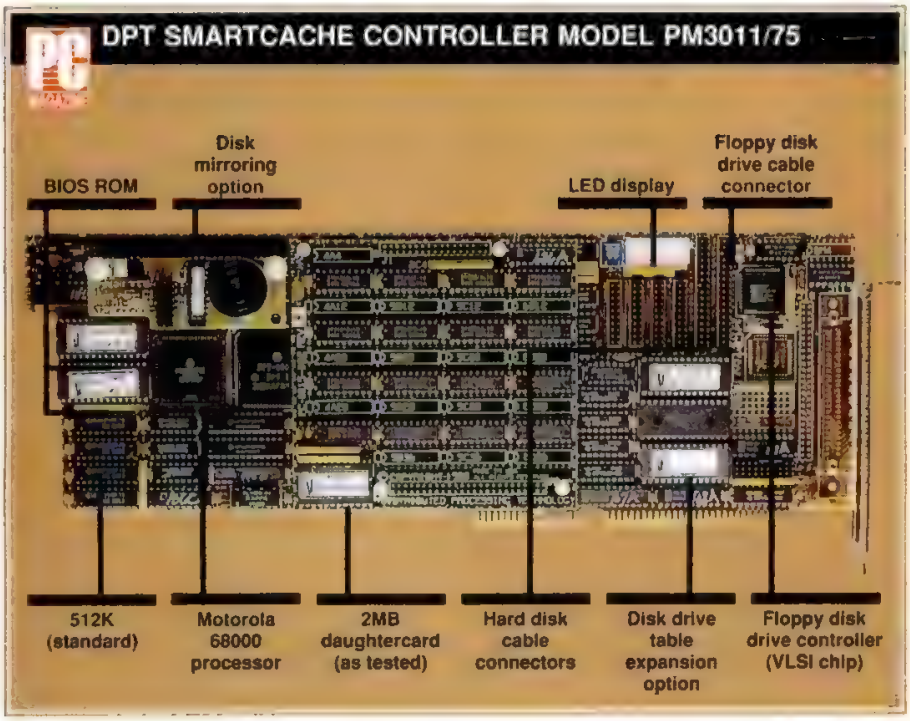
DPT SmartCache Controller model PM3011/75

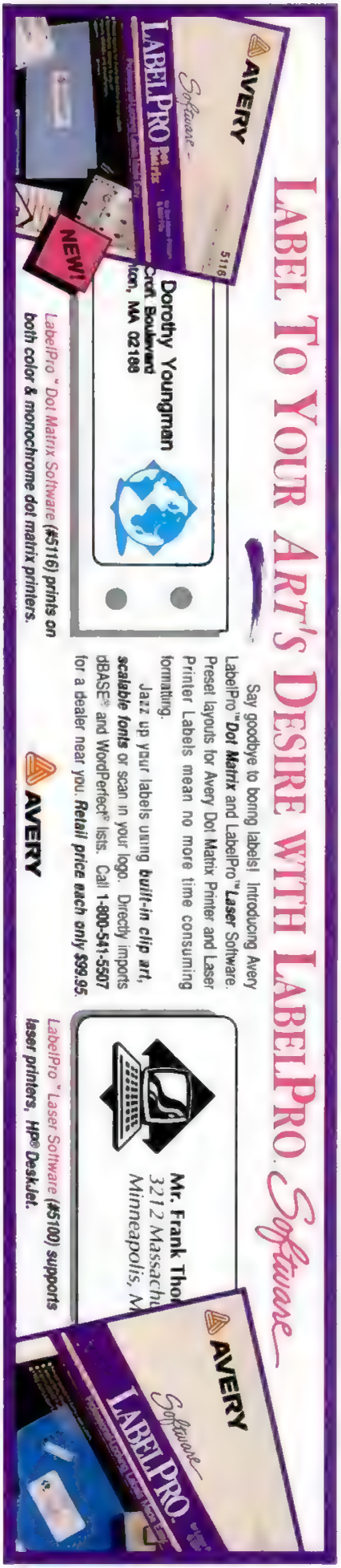
The SmartCache PM3011/75, a combination ESDI and floppy disk controller from Distributed Processing Technology (DPT), carries a $1,230 list price for the base unit with a 512K cache. The additional 2MB daughterboard, which sells for $545, and the optional $50 BIOS disk drive table expander brought our test unit's list price up to $1,825—making it the most expensive card we tested.

All that money gets you a full-length card as tall as a standard AT-style card that requires a 16-bit slot for operation. You can add a 2MB or 4MB daughtercard to the 512K base model, giving a maximum 4.5MB cache on the card. You can also add a separate 8-bit card, bringing the total possible cache to a full 16MB. However, since the memory chips come soldered to the proprietary cards, you'll need to go to DPT for your memory.

DPT offers numerous options for the SmartCache card. You can add extra memory with a 2MB or 4MB daughtercard, which carry list prices of $545 and $895 respectively. There is also a second memory card that requires its own slot; this costs $1,095 for 4MB. An optional SCSI interface doesn't take advantage of the card's caching feature, and lists for $175 without the floppy controller; with the floppy controller the price is $270. Finally, DPT also makes caching controllers for MFM and RLL drives. These have same 512K base memory and list price of $1,230 as the ESDI model we tested. All models are also available without the floppy controller for a base price of $1,150.

There are other options you can add. The unit we tested had the $50 BIOS table expander chip, which allows the controller to recognize more than 300 different drive types without the need to load special drivers. There is also a disk mirroring option





CIRCLE 204 ON READER SERVICE CARD

DATA ON THE FAST TRACK: Disk Caching Approaches

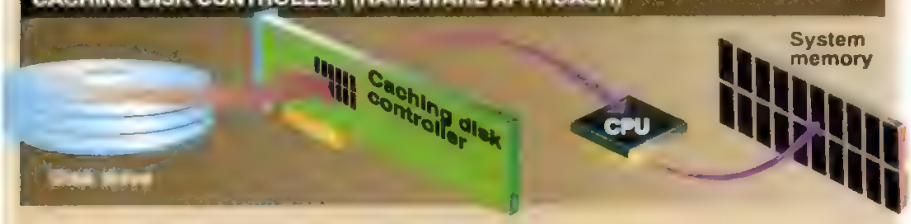
by Alfred Poor

It's clear disk caching yields impressive performance gains, but not so clear which approach to caching is best. There are two basic designs: the caching disk controller and the caching program.

STANDARD DISK CONTROLLER (NO CACHING)

In a typical PC, there is no caching of data from a disk drive. Information required by the CPU is requested from the disk via the controller and placed directly into system memory. The drive must be accessed for every request.

CACHING DISK CONTROLLER (HARDWARE APPROACH)



A cache improves disk performance by reading more data at one time and loading it into memory where the CPU can quickly access it. Caching disk controllers represent a hardware solution to the problem.

A processor that is on the card manages its own private memory. When the CPU requires information from the disk, the controller provides it from its cache, summoning more data from the disk as it is needed.

This approach reduces the CPU's load and provides advantages for installations that require intensive CPU operation—multiuser and multitasking operating systems, for instance. Some disk caching controllers offer additional benefits, such as automatic disk mirroring, which can maintain the same data on two identical hard drives for added reliability in network file servers.

CACHING PROGRAM (SOFTWARE APPROACH)

Software caching utilities provide many of the same benefits of a caching disk controller, but instead rely on some of the computer's expanded or extended memory for the cache. These programs also rely on the CPU for cache management. For single-user applications, these programs often provide equal or better performance gains at a much lower cost than hardware alternatives.

listing for $800 that lets you store the same information simultaneously on two ESDI drives. In the event that one drive fails, the other will continue to operate without interruption. You can set up two pairs of mirrored drives with the SmartCache PM3011/75 using this option; you can even mirror disks of different sizes, though you will be restricted to the capacity of the smaller drive.

The card has a fairly crowded layout, with lots of individual chips. There are four VLSI surface-mounted chips, plus a Motorola 68000 processor to handle the board's tasks. The most unusual feature, however, is a bank of LEDs mounted near the top edge of the board. During power-up and controller activity, ten lights flash in different combinations and sequences to indicate different diagnostic messages. While that is useful, the lights are even more entertaining when the controller is "idling"—the LEDs light in an animated sequence that flows back and forth from one end to the other, creating a mesmerizing pattern.

The PM3011/75 can drive a pair of floppies and up to four ESDI drives. The cable connectors are not labeled clearly on the card itself, so you'll need to refer to the technical illustration at the end of the manual to make the proper connections. While the ends of the connectors are marked to show where pin 1 is located, the connectors are so close together that it can be tricky getting the ribbon cables properly seated and routed.

The documentation itself gives good detail on all aspects of installation. Configuration is straightforward, and starts by running a utility program. It automatically

FACT FILE
EDITOR'S CHOICE

DPT SmartCache Controller model PM3011/75
Distributed Processing Technology, 132 Candace Dr., Maitland, FL 32751; (407) 830-5522
List Price: With 512K RAM, $1,230 (base price); with 2MB memory module, $1,825 (price as tested).
Requires: AT or compatible, ESDI hard disk, 16-bit slot.
In Short: The DPT SmartCache combines floppy and hard disk support, backed up by a 68000 processor and up to 16MB of cache. Options such as disk mirroring and expanded drive table augment its performance and utility, but you pay a premium price.

CIRCLE 821 ON READER SERVICE CARD

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(7BM749)

(9CM082)

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Shown: Genius mouse—model GM-F302.

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And if you're creating art, or quarterly reports, perhaps a memo, or the Great American Novel, then the Genius GM-F302 mouse helps you express yourself very, very easily.

Elegant in aspect and simple to use, it operates your software with fluid capability and mastery.

So easy for the novice to use, and amazingly versatile for the advanced power user. And at any time, the GM-F302 mouse can be switched between two mouse modes by a simple flip of a switch. Plugging into Com 1 through Com 4, it has three different ranges of dynamic resolution and features X-Y lock. There's even a handy utility included to "mousify" all your software so you'll never have to take your hand off the mouse at all.

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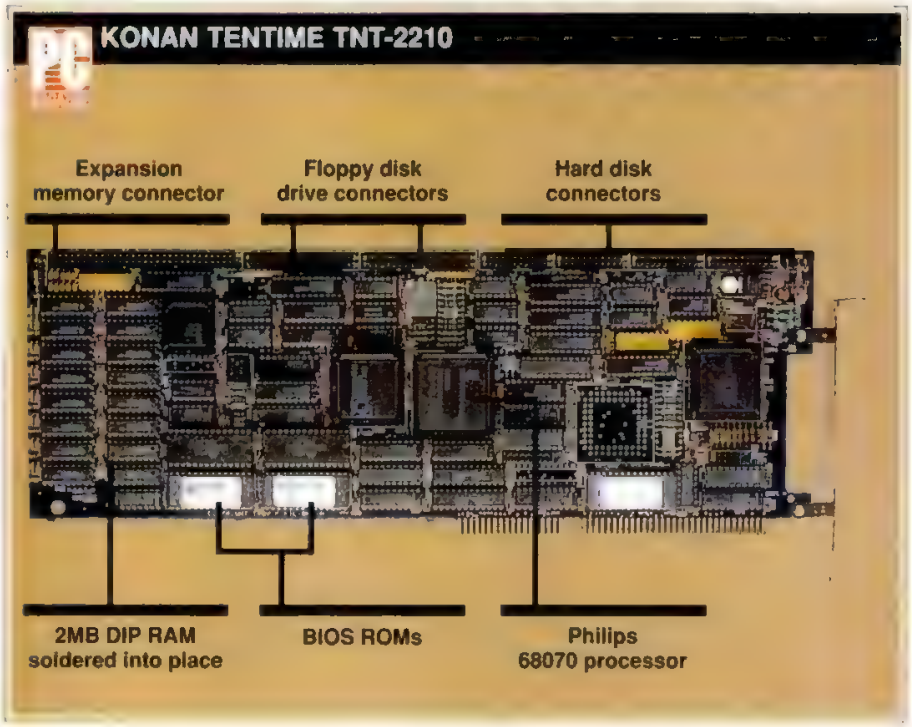
CIRCLE 492 ON READER SERVICE CARD

sets the drive type in your computer's CMOS memory to type 1. You then choose either a simple low-level format or a format with certify—this takes much longer but checks for disk defects. Once the format was complete, I simply used the Compaq DOS 3.31 utilities to create a single DOS partition which formatted to a 300MB drive.

The SmartCache was an outstanding performer in our tests. It was often the fastest of the cards we tested, and when it did come in second, the difference was negligible. Though it was the only card to be tested at 2.5MB instead of 2MB, there was nothing in the test results that indicated this was the reason for its performance advantage.

The DPT SmartCache looks like it may be the Cadillac of caching controllers; it performs well and has plenty of add-on options, but you pay for the extra and the increase may or may not be worth the incremental performance. If you need disk mirroring or have an open budget to create a top performing server for a network or multiuser system, the DPT card should be on your shopping list.



KONAN INC.

Konan TenTime TNT-2210

Konan has the dubious distinction of selling the most expensive base model of all the caching disk controllers reviewed. But where the competitors give you a paltry 512K of memory—if any—on their base models, Konan stuffs its $1,395 card with a full 2MB.

The company used to sell its cards with as little as 128K, but the drop in memory prices and increasing system demands made it impractical to offer less than 2MB—most users were upgrading to that level anyhow, so why not start there?

The TNT-2210 is a full length, AT-size card that requires a 16-bit slot. Everything is arranged in a tight layout; there is only one extra wire on the back to indicate design changes with the rest of the construction being neat and clean. There are four VLSI chips including the Philips 68070 processor that runs the cache. A connector for an optional memory-expansion daughterboard can add up to 8MB of memory.

Konan offers this additional memory card for a list price of $995 with 2MB memory installed and $1,595 with 4MB. You can also get a 64K nonvolatile cache RAM for $200; this nifty device provides a battery backup for all cached writes. Konan also offers MFM and RLL caching controllers ($495 and $545 respectively), which are equipped with a 128K static RAM cache and battery backup but offer no memory upgrade.

The double-pin connectors for the disk drive cables are arranged along the top edge of the card. The controller can support two floppies and up to four ESDI hard drives. You will need to refer to the manual to determine which cable goes where, but all you get is a typewritten table. An illustration would be better, and silk-screened labels right on the card would be easier still. The rest of the manual is also typewritten, but adequate to explain the installation process.

The low-level format utility is simple to operate, but unlike some other products, it doesn't offer an optional disk certification process to locate disk defects. Once the low-level format was complete, it was a simple matter to use the Compaq DOS 3.31 to partition and format the drive to create a single 300MB disk.

In PC Labs' performance tests, the Konan turned in acceptable but unspectacular timings. The only unusual results were particularly slow sequential read times. According to a Konan representative, this is because the card runs its own real-time operating system. That imposes a certain amount of overhead for every disk transaction, whether for one sector or many. Consequently, our tests with relatively small records result in a particularly heavy load for the card. According to Konan, when other applications call for much larger chunks of data, the TenTime should perform about the same while other cards will slow down. The company contact also pointed out that the card is designed to perform better in more random and varied application environments than the tightly controlled tasks demanded by PC Labs' performance tests.

Konan is scheduled to release some

FACT FILE

Konan TenTime TNT-2210
Konan Inc., 1829 W. Drake Dr., Tempe, AZ 85283; (602) 345-1300.
List Price: With 2MB RAM, $1,395 (base and tested price).
Requires: AT or compatible, ESDI hard disk, 16-bit slot.
In Short: The Konan TenTime TNT-2210 did not produce winning times in our tests, but according to a company representative, it is designed to perform best in multiuser or multitasking environments. As such, it's a less attractive value for single-user DOS applications.

CIRCLE 622 ON READER SERVICE CARD

HOW WE TESTED CACHING DISK CONTROLLERS

by Robert W. Kane

To determine the performance differences and similarities among the four caching disk controllers reviewed, we modified the DOS File Access test from PC Labs' Benchmark Release Series 5.1. It was modified to exercise the controller's ability to handle small and large records over a range of file sizes. We created ten new tests—five for small records (200 bytes), and five for large records (2,048 bytes).

We are reporting the results from the following six tests: Small-Record Create, Small-Record Random Write, Small-Record Sequential Read, Small-Record Random Read, Large-Record Sequential Read, Large-Record Random Read. We are not reporting the results from the Large-Record File Create, Small-Record Sequential Write, Large-Record Sequential Write, or the Large-Record Random Write as they are similar to the Small-Record Create results.

For each test, we ran the controllers through seven different file sizes, from 60,000 bytes to 3,932,100 bytes. For each file size, the test was performed five times; an average of the five trials is reported on the graphs. These file sizes do not necessarily represent typical files that a DOS user would encounter; instead, they show how the controllers performed inside the cache (when the file is smaller than the cache) and outside the cache (when the file is larger than the cache). We are reporting the results for five file sizes; we omitted the results from the two smallest file sizes because there was essentially no difference in performance among the controllers using those file sizes. (Please note: times are reported in seconds.)

The controllers were tested in a Compaq Deskpro 386/25 Model 310 with 4MB of system memory and a 310MB hard disk. The controllers were configured and installed according to the vendors' instructions, including low-level disk formatting. All were equipped with at least 2MB of RAM cache—the DPT SmartCache had 2.5MB. The systems were warmed up for 15 minutes after controller installation, allowing all components to reach operating temperature.

For the sake of comparison, we're including results for Compaq's standard 386 hard disk controller—first, on its own (without a cache) and then with Compaq's software cache (which comes with all Compaq machines) running in extended memory. We sized the software cache at 2MB to match the cache size of the controllers. We tested the software cache in its default configuration, which does not cache disk writes.

INTERPRETING THE RESULTS

When operating within the cache, there was little difference among the controllers. The DPT SmartCache proved to be the fastest overall, although the difference between the fastest and the slowest controllers on most of the tests was just a few seconds.

Notice that in the accompanying graphs, the performance curves for the controllers were essentially flat in the Random tests but curved slightly upward for the Sequential tests as the file size increased. This is because a cache, by its very nature, pieces together random pieces of data for retrieval. Sequential file accesses are more dependent upon the controller's ability to find the requested data in the cache and then move it to system memory as quickly as possible.

The relative flatness of the curves for file sizes within the boundaries of the cache size indicates that, in order to get the maximum benefit from caching, you should choose a cache size larger than any of your system's files.

The most significant point demonstrated by the results is that the Compaq controller *with* Compaq's software cache installed performed as well as (and in some instances better than) the caching disk controllers reviewed in this story. With its cache write option installed, it would do better on the Create tests, giving it performance comparable to the DPT. And, because the software cache operates in fast 32-bit system memory, it isn't limited to the 8-MHz, 16-bit bandwith for moving data from the cache to system RAM, which more than makes up for the CPU overhead involved in managing a software cache.

For single-user DOS applications, a software cache is at least as effective as a hardware cache. However, for file servers or multiuser hosts, a caching disk controller provides an effective solution to the I/O bottleneck that systems in these enivorments face. ■

new drivers for the card in the near future which should reduce this overhead load. These drivers will be loaded in the CONFIG.SYS file at boot-up, but the card will be able to perform normally without them. Konan also intends to add a disk mirroring feature in the future.

For the moment, the Konan controller is not a compelling attraction for single-user DOS systems. Its benefits are more likely to shine in large multiuser or multitasking systems such as local area network servers or Unix installations.

PERCEPTIVE SOLUTIONS INC.

Perceptive Solutions hyperSTORE-1600

Kids aren't the only ones who get to play with great toys. Perceptive Solutions Inc. (PSI) has created the power user's ultimate Lego set for disk controllers: the hyperSTORE-1600. Unlike most competitors, it's completely modular, so you can build just what you need.

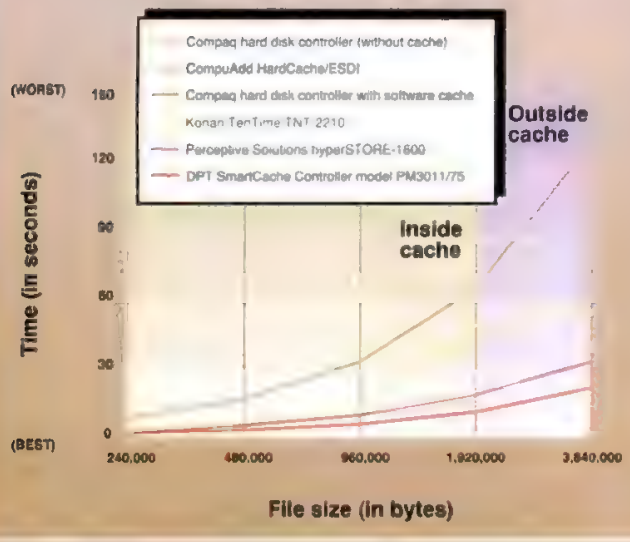
Start with the base unit that carries a list price of $890 and you get a full-length XT-height card that has a floppy disk port but no memory and no disk interfaces; these come on separate daughterboards that can be stacked on top of each other. The base card does sport slots for four SIMMs, and has an 80280 processor on-board. Since its SIMMs can be standard, you can get the memory you need from PSI or from other sources. The board is limited to 4MB of

PERFORMANCE TESTS: CACHING DISK CONTROLLERS

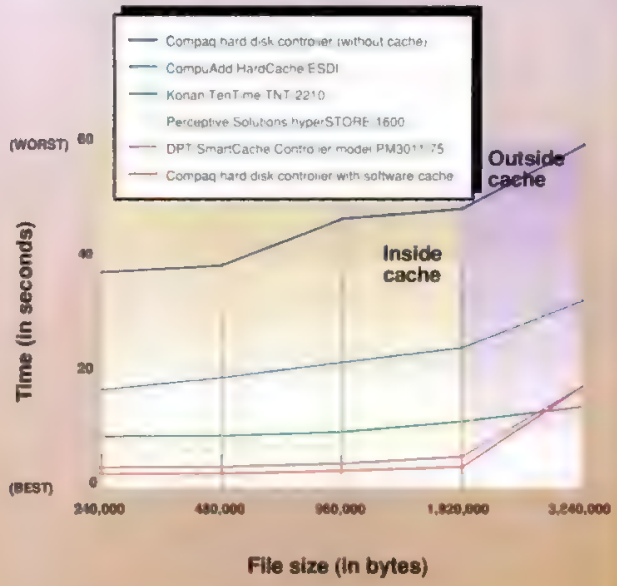
SMALL-RECORD CREATE

This test involves creating a file with 200-byte records, which is about the size of a record in a database file.

On this test, the fastest controller is the DPT SmartCache. But the differences among the DPT SmartCache, Konan TenTime TNT-2210, and Perceptive Solutions hyperSTORE-1600 were negligible, as long as all three boards operated well within the boundaries of the cache. Behind these three, the CompuAdd HardCache/ESDI performed identically to Compaq's hard disk controller and the Compaq controller with the software cache. This reflects CompuAdd's conservative design philosophy of not caching disk writes, which ensures no loss of data.



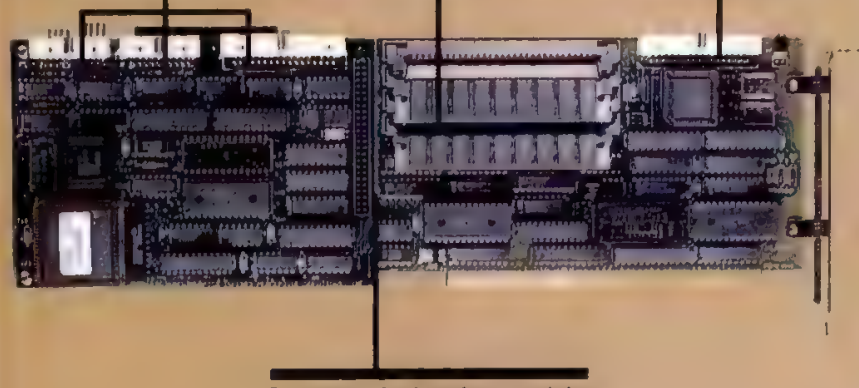
SMALL-RECORD RANDOM WRITE



Comparable to updating a record in a database file, this test writes 200-byte records to a file.

The fastest performer on this test was the Compaq controller with the software cache. Its performance was only slightly faster than the DPT SmartCache, Perceptive Solutions hyperSTORE-1600, or the Konan TenTime. Once outside the cache boundaries, all the controllers took a sharp upturn in the time required to perform the write, except for the Konan, whose performance remained flat. This was due in large part to the Konan's on-board operating system, which maintains the same level of cache performance regardless of file size.

PERCEPTIVE SOLUTIONS HYPERSTORE-1600



memory. The SCSI and ESDI adapters cost $405, the price of the RLL adapter is $335, and the MFM adapter costs $405. There is also a mirroring option available for $295.

The hard disk interface comes on a daughterboard that mounts on the end of the card. Our tested configuration for the hyperSTORE carried a list price of $1,695 (including memory supplied by PSI) and came with 2MB and an ESDI interface that supports two hard disk drives. The unusual feature is that you can stack up to four disk interface cards on the base card. Since you can daisy-chain up to seven SCSI drives off a single SCSI port, the hyperSTORE-1600 can drive as many as 28 SCSI drives at the same time.

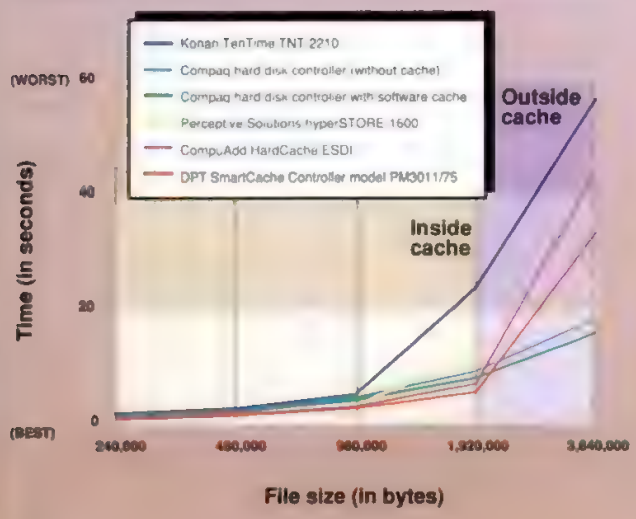
Installation and setup were fairly straightforward. The documentation is filled with clear illustrations, making it easy to identify the different jumper locations and choose the correct setting. The trickiest step in the installation is running

PERFORMANCE TESTS: CACHING DISK CONTROLLERS

SMALL-RECORD SEQUENTIAL READ

Similar to running a database report, this test reads 200-byte records sequentially from a file.

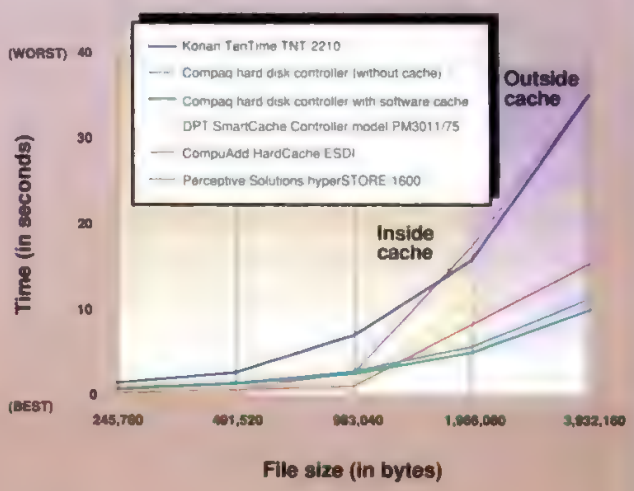
Within the cache boundaries, all of the boards performed almost identically on this test; the DPT controller had a slight edge. As the file size approached that of the cache, the Konan displayed markedly slower performance than the other controllers. Once again, this was due to the on-board operating system, which has the same operating overhead regardless of record size.



LARGE-RECORD SEQUENTIAL READ

Comparable to loading a program from disk, this test reads 2,048-byte records sequentially from a file.

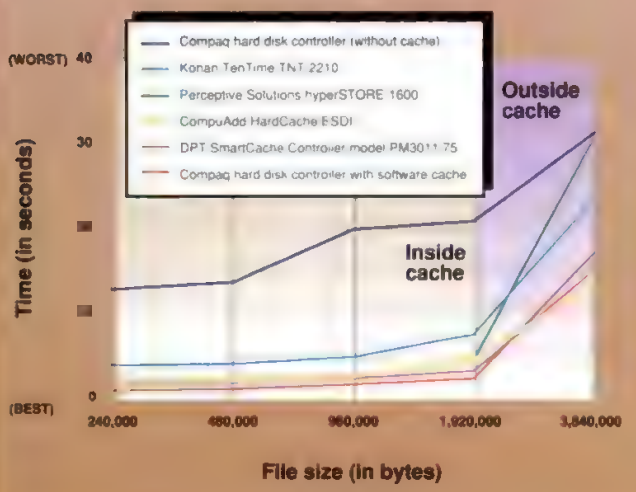
All the controllers turned in slower times than Compaq's hard disk controller with file sizes just within and beyond the bounds of the cache. Even the Compaq software cache proved to be of little help in reading large-record sequential files; juggling large-record sequential data in the cache creates much more overhead than simply reading the data from disk into memory.



SMALL-RECORD RANDOM READ

This test reads 200-byte records randomly from a file, akin to searching for a database record.

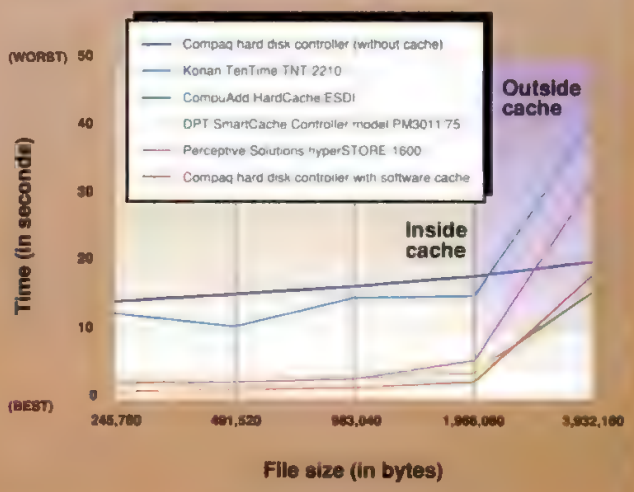
Once again, all the boards performed similarly within the cache boundary, this time with the Compaq controller with software cache edging out the DPT in overall performance. The efficiency of Compaq software cache is best with random reads because it can search and transfer random records faster in high-speed 32-bit memory than a hardware controller can in a 16-bit, 8-MHz bus.



LARGE-RECORD RANDOM READ

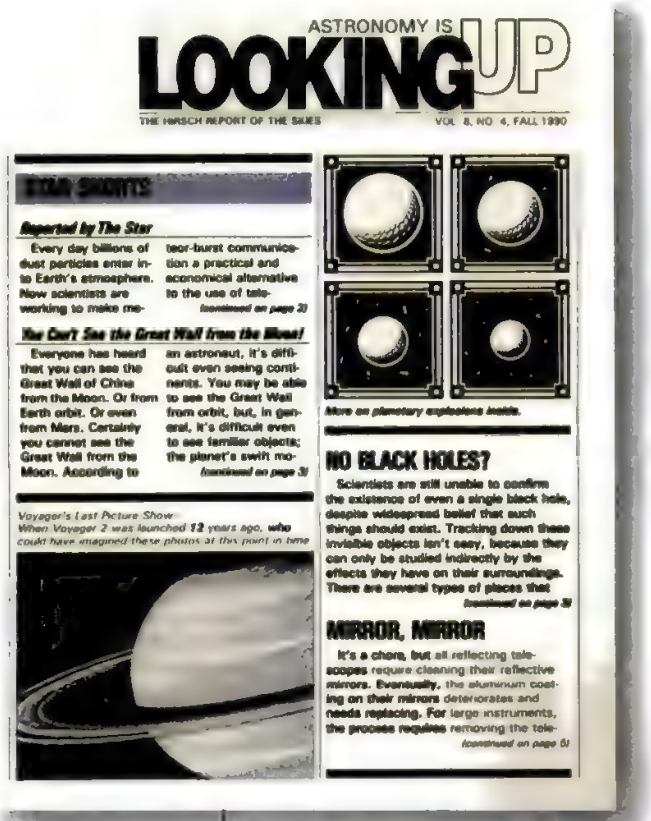
This test reads 2,048-byte records randomly from a file—similar to reading a word processing document or spreadsheet data file from disk.

As in the Small-Record Random Read, Compaq's controller with software cache proved to be the fastest overall in this test, enjoying a slight advantage over Perceptive Solutions hyperSTORE-1600, the DPT SmartCache, and the CompuAdd HardCache/ESDI. Notably slower than these controllers was the Konan TenTime. While its performance was faster than the standard Compaq controller, its caching algorithm had the most difficulty in dealing with random large records.



Other laser printers play with one standard dot size.

HP makes it a



ASTRONOMY IS LOOKING UP

THE HIRSCH REPORT OF THE SKIES VOL. 8, NO. 4, FALL 1990

STAR SHORTS

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. Now scientists are working to make meteor-burst communication a practical and economical alternative to the use of tele-

(continued on page 2)

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift mo-

(continued on page 3)

More on planetary explosions inside.

NO BLACK HOLES?

Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

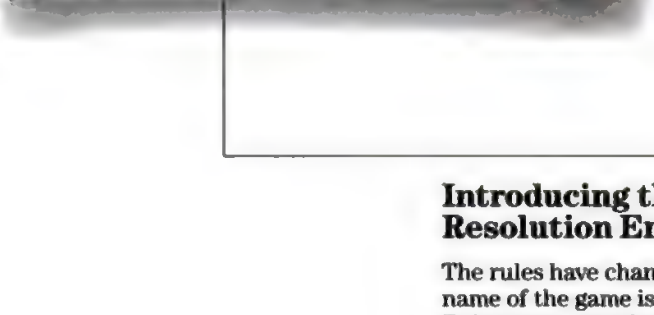
(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

(continued on page 5)

Voyager's Last Picture Show
When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time



CHAIN REACTION

BAGOT'S CHEMICAL LETTER

JUNE 9, 1990
VOLUME FOUR
ISSUE THREE

New Leaps in Metal-Organic Chemistry

Metal organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example, poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. *(continued next page)*

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 6000 elements, alloys, and compounds have been found to superconduct! *(continued next page)*

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. *(continued next page)*

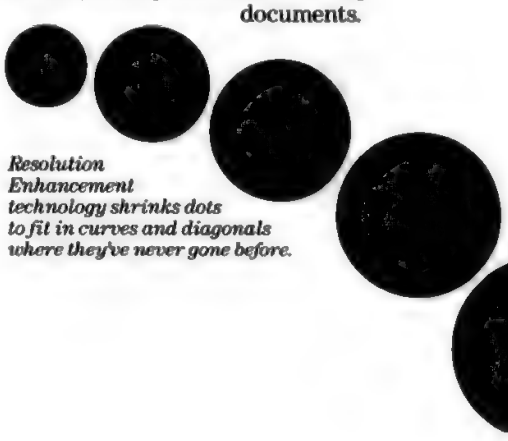
Fifty Years Ago

Rumor has it that before WWII, our chemists were experimenting with a distilling process to lower the calories of ordinary beer. Abandoning the research at the onset of world war, researchers then pursued the development of a shelf-stable C ration. Don't believe all rumors.

Introducing the new HP LaserJet III printer with Resolution Enhancement technology.

The rules have changed. Now the name of the game is Resolution Enhancement technology. You'll call it the best thing to happen to laser printing since the very first HP LaserJet printer. It gives you clearer resolution. Curves that really curve. And edges that are never jagged.

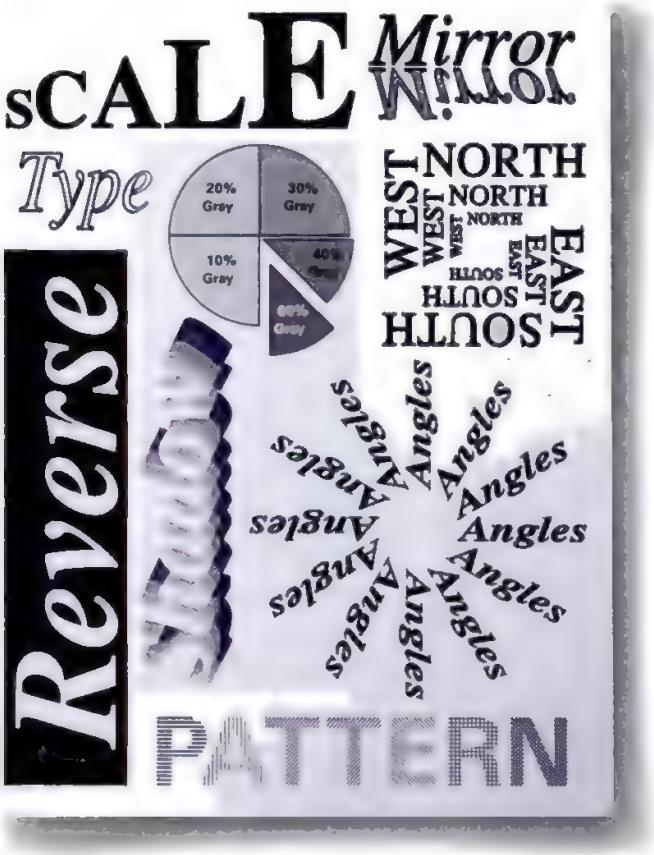
Instead of a "one-size-fits-all" dot, HP's built-in intelligence varies dot sizes. So they can fill areas where they could never go before. For clearer, more professional-looking documents.

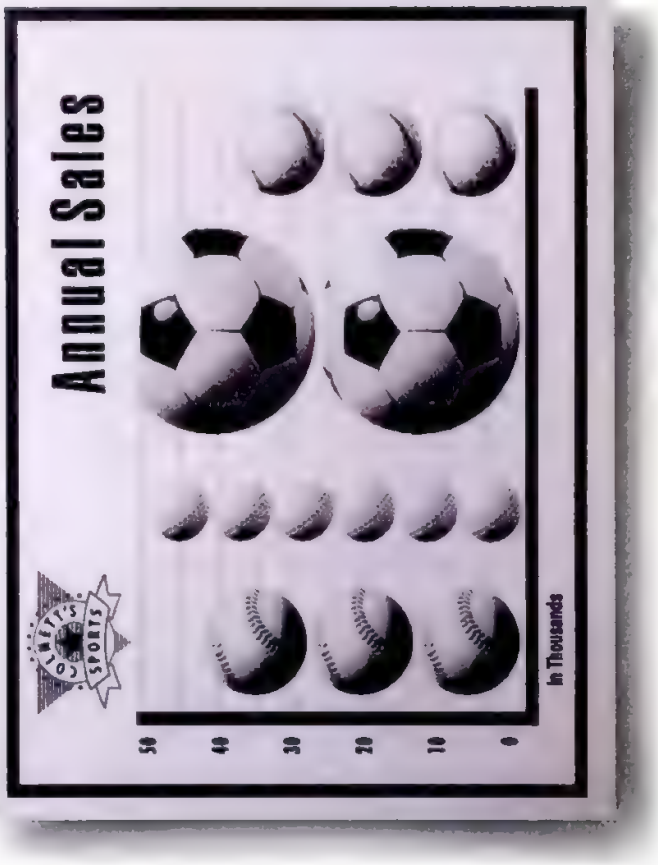


Resolution Enhancement technology shrinks dots to fit in curves and diagonals where they've never gone before.

©1990 Hewlett-Packard Company PE12003

whole new ball game.





But there's more than better print quality. 14 bit-mapped fonts and 8 internal scalable typefaces provide thousands of options. And enhancements to our PCL5 printer language, including our HP-GL/2 graphics language, let you print portrait and landscape on the same page. Reverse and angled type. Spirals. Even shaded text. You can also plug in Adobe PostScript® software.

For all its new features, the $2,395* list price of the HP LaserJet III is a good deal less than the HP LaserJet

Series II printer it replaces. With the same hardware compatibility, wide range of applications, 8 ppm print speed, and software compatibility, including WordPerfect 5.1 and WordStar® 6.0. And the same reliability as the rest of the HP printer family.

So call **1-800-752-0900, Ext. 1007.** Ask for our booklet on Resolution Enhancement technology and where to find your nearest authorized HP dealer. We'll put you in a whole new league.

There is a better way.

HEWLETT PACKARD

*Suggested U.S. list price. WordStar is a U.S. registered trademark of WordStar International Incorporated. Adobe and PostScript are registered trademarks of Adobe Systems, Inc.

CIRCLE 491 ON READER SERVICE CARD

CACHING DISK CONTROLLERS: SUMMARY OF FEATURES

Products listed in ascending price order

In their tested configurations, the four caching disk controllers we reviewed are more similar than dissimilar. At our insistence, each was configured with an ESDI interface and with at least 2MB RAM on-board. In addition, they all support the following operating systems: DOS, OS/2, Unix, and Novell *NetWare*. Although each product offers its own propnetary approach to setup, all four also support the AT-drive-type table. All require you to do a low-level reformat of your hard disk as a step in the installation process.

Keep in mind that you are not limited to the features as they appear in our tested configurations. All four vendors offer a full product line with lots of options, including the interface. Some options are available for each model we tested; others are available as other caching disk controller models. Be sure to read the reviews for a full listing of features and prices offered by each vendor.

	CompuAdd Corp. **HardCache/ESDI**	Konan Inc. **TenTime TNT-2210**	Perceptive Solutions **hyperSTORE-1600**	DPT SmartCache **Controller PM3011/75**
List price (as tested)	$705	$1,395	$1,695	$1,825
POWER REQUIREMENTS				
Maximum voltage	5	12	5	5
Maximum amperage	2	2	2	5.35
MEMORY				
Minimum RAM required	256K	2MB	512K	512K
Maximum RAM supported	4MB	10MB	4MB	16MB
RAM as tested	2MB	2MB	2MB	2.5MB
Maximum number of cache ways	8	3	14	Variable
PHYSICAL SPECIFICATIONS				
Number of hard disks supported	2	4	2	4
Number of floppy disk drives supported	2	2	2	2
Board supports disk other than ESDI	❑	❑	■	❑
Board supports disk mirroring as option	❑	❑	■	■
Board form factor:				
Height	XT	AT	XT	AT
Length	Full	Full	Full	Full
Slots occupied with base memory	1	1	1	1
Slots occupied with full memory	1	2	1	2
8-bit slot	❑	❑	❑	❑
Maximum bus speed (MHz)	12.5	Unlimited	12.5	16
Maximum transfer rate (Mb/sec)	24	32	5	4
Multiple controllers per PC	❑	❑	■	■
Cache processor	ASIC and Intel 80188	Philips 68070	Zilog 80280	Motorola 68000
CONFIGURATIONS				
Supports nonstandard drive types through hardware or software	Hardware	Hardware	Software	Hardware
Largest drive size supported	1GB	32GB	1.8GB	4GB
Cylinders supported	4,096	2,048	65,525	2,048
Heads supported	16	16	256	16
Sectors per track supported	256	63	63	255
IRQ levels supported	14	14	5, 12, 14, 15	7, 12, 14
I/O address range supported	1F0h–1F7h, 170h–177h	1F0h–1F7h	1F0h–1F7h, 170h–177h	1F0h–1F7h, 170h–177h
ROM BIOS addresses supported	C800h–C9FFh, CA00h–CBFFh	C800h, CC00h, D000h, D400h, D800h, DC00h	C800h, DA00h, D800h	C800h–C9FFh, D800h–D9FFh
SOFTWARE INCLUDED				
Setup	■	■	■	■
On-board diagnostics	■	■	■	■
Additional diagnostics on-disk	❑	■	❑	❑
Performance tests	■	❑	❑	❑

—Editor's Choice ■—Yes ❑—No

your computer's SETUP utility in order to change the CMOS setting so that it appears that there are no hard disks installed. You must complete this step before you can install the card.

You'll find the installation and low-level format utility has a fairly intuitive interface. The card can be set to run in different modes, depending on whether you want more speed or better compatibility with the Western Digital controller standard. You can also specify how extensive the surface analysis will be during the format process. Once the formatting was complete, I was able to run the Compaq DOS 3.31 FDISK and FORMAT utilities to create a single 300MB drive.

The caching algorithm resides in software, which means users can upgrade painlessly. An announced BBS should make upgrading even easier.

In PC Labs' performance tests, the hyperSTORE-1600 turned in impressive times. It was rarely fastest, but it was usually near the top speed. The hyperSTORE is engineered to run safely in expansion bus slots at speeds up to 12.5 MHz; in some compatible systems that allow you to set bus speeds, this option permits even better performance.

PSI's controller provides good performance at a competitive price, but its greatest strength lies in its ability to change personalities and work with different disks. This flexibility means that you don't have to change controllers to use a different disk interface, and in many cases you'll be able to keep the old drives even after you add the new ones—a unique approach to keeping your options open. ■

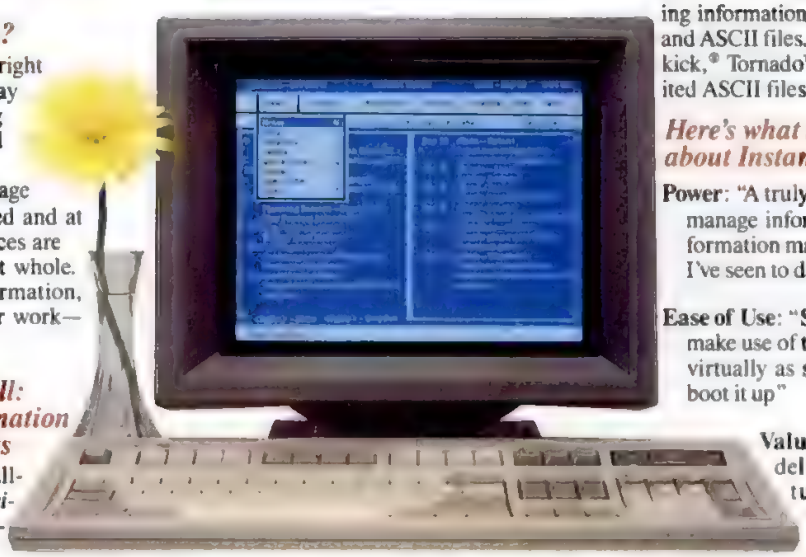
Alfred Poor is a contributing editor of PC Magazine.

FACT FILE

Perceptive Solutions hyperSTORE-1600
Perceptive Solutions Inc., 2700 Flora St., Dallas, TX 75201; (800) 486-FAST, (214) 954-1774.
List Price: With no RAM and no media adapter, $890 (base price); with 2MB and ESDI media adapter, $1,695 (price as tested).
Requires: AT or compatible, hard disk supported by media adapter, 16-bit slot.
In Short: The hyperSTORE-1600's modular design makes it the most flexible disk controller reviewed. It carries a competitive list price, and turned in respectable times on the benchmark tests.

CIRCLE 623 ON READER SERVICE CARD

Goodbye, Paper Chase
Hello, Instant Recall™



Drowning in Information?

All those phone numbers, bright ideas, schedules, reports, stray facts, and to-do lists aren't going to stop coming at you fast and furiously.

You need a better way to manage it all. So everything's organized and at your fingertips. So separate pieces are pulled together into a coherent whole. And you can *harness* the information, using it to forge ahead in your work—better and faster.

Introducing Instant Recall: The First Personal Information Manager that really works

Instant Recall is the only full-featured PIM that's *memory resident, popping up over any software you use*—without interrupting your workflow. An incredible time-saver. And something no other personal information manager can offer.

Plus, it's memory-resident in *just 32K* (about half the memory needed by Sidekick®), leaving plenty of room for other programs.

Instant Recall replaces desktop organizer and text database software with an *integrated solution*. It makes connections between pieces of information. Gives you multiple perspectives. Creates time-lines from dates you've entered piecemeal. So it *actually shoulders much of the work for you*. And it's truly easy to start up and use.

Instant Recall is always just a keystroke away—yet it needs only 32K of memory

Hardware Compatibility
IBM PC, XT, AT, PS/2, or compatible, 512K RAM (32K RAM in background mode), DOS 2.1 or higher (DOS 3.0 or higher for memory resident operation), at least 720K capacity on a single floppy or hard disk.

Instant Information your way

Instant Recall takes any kind of information. Structured or freeform. Any single item can include up to 65,000 characters (over 30 pages) of text. And *four familiar formats handle it all*:

Notes: for freeform text—ideas, memos, lists, reports.

Tasks: for tracking and delegating, with priorities, target dates, advance notice.

Schedule: for managing time—with automatic conflict checking, recurring events, week-at-a-glance display.

People: for names, addresses, phone numbers, unlimited notes. With follow-up dates, auto dialer, address copy to any word processor—you'll never type an address again!

Integrated views make connections for you, speeding your work

Instant Recall lets you pull together notes, tasks, schedules, and people information on a *single screen—by topic, date, person, priority, or embedded text*.

Instant Recall also brings time-sensitive items to your attention on any date you choose. You can set advance notice for upcoming activities. View overdue items. Or automatically pop up alarm messages over other software.

Other unique features lighten your load

Instant Recall is the *only* general purpose PIM which offers a pop-up activity timer, a phone dialer, alarm messages, scheduling and tasks for multiple individuals and groups, automatic conflict checking, advance notice, and recurring activities.

Other convenient features include mailing lists and labels, direct copy of name and address to any word processor, overdue notice, follow-up dates, password protection, flexible printed reports, and a clipboard for exchanging text with other programs.

CIRCLE 117 ON READER SERVICE CARD

Ready to use right out of the box

Instant Recall comes ready to work for you from day one. An intuitive user interface and context-sensitive help make it exceptionally easy to learn and use. You don't have to retype information that's already on your computer—Instant Recall has a built-in clipboard for pulling information directly from other programs and ASCII files. Plus transfer utilities for Sidekick,® Tornado™, MemoryMate,® and delimited ASCII files.

Here's what the experts say about Instant Recall:

Power: "A truly impressive, productive way to manage information...the best personal information manager I've seen to date" — PCResource

Ease of Use: "So intuitively designed, you can make use of the program virtually as soon as you boot it up" — INFO WORLD

Value: "Instant Recall delivers high-end features at a bargain price" — PC MAGAZINE

Try Instant Recall free for 30 days

Experience the difference Instant Recall makes—the remarkable gain in control, speed, and effectiveness. You can't lose. Because this cutting-edge PIM is completely guaranteed. If you're not 100% satisfied, simply return it for a full refund—no questions asked.

So order Instant Recall today. And be on top of things tomorrow.

INFO WORLD — BEST IN ITS CLASS

INFO WORLD — EXCELLENT VALUE

Call toll free: 1-800-848-4970

Yes! I want to eliminate the paper chase with Instant Recall. I understand that this innovative PIM is completely guaranteed. If not completely satisfied, I may return it within 30 days for a full refund. Enclosed is my check for $99.95 plus $5.00 shipping and handling (AZ residents add 7% sales tax).

Name _____
Address _____
City _____
State _____ Zip _____
Day Phone (_____) _____
Check disk size: ☐ 5.25" ☐ 3.5"
Charge my ☐ Visa ☐ Mastercard ☐ Amex
Card # _____ Exp. _____
Signature _____

CHRONOLOGIC CORPORATION
5151 North Oracle • Suite 210 • Tucson, AZ 85704
Tel (602)293-3100 FAX (602)293-0709
Toll free: 1-800-848-4970 PCM0612

WHICH BABY WOULD YOU

BABY HAILEY

Height: 22"

Weight: 10 lbs. 6 oz.

Footprint:

Expandable: Yes, but growth takes roughly 16 years.

Configuration: One-of-a-kind.

Guarantee: None.

Warranty: None.

Service: You're on your own. Constant service required.

Price: Priceless. This device is not for sale.

RATHER HAVE ON YOUR DESK?

BABY TOWER

Height: 16″

Weight: Depends on system configuration.

Footprint: 8″ x 15″

Expandable: Yes. 8 full-length expansion slots plus room for 5 half-height storage devices.

Configuration: Custom-built to your specifications. Any Gateway 2000 system is available in the baby tower case. See Gateway 2000's advertising insert in the front of this issue.

Guarantee: 30-day money-back guarantee.

Warranty: One year.

Service: Lifetime toll-free technical support. On-site service to most locations.

Price: No extra charge for baby tower case. See Gateway 2000's advertising insert for best system prices in the industry.

GATEWAY2000

800-523-2000

610 Gateway Drive • North Sioux City, South Dakota 57049 • Telephone 605-232-2000 • Fax 605-232-2023

CIRCLE 373 ON READER SERVICE CARD

(MOST PC USERS WANT TO TORTURE THE INVENTOR OF DOS.)

Aren't computers supposed to make life simpler?

Do all your sentences start with C?

Did it ever occur to you that normal people might use DOS?

Was your father a dentist, or do you...?

How many times have you seen the words Bad Command?

Do you get migraines from all those How to Use DOS books?

WHY BACKSLASHES?

Is your entire vocabulary limited to words of eight letters or less?

Why, after six revisions, hasn't DOS been simplified?

How much money do you think Corporate America has wasted on DOS training?

DID DOS ACTUALLY MAKE SENSE TO YOU, OR DID YOU JUST RUN OUT OF TIME?

WE JUST WANT TO ASK HIM A FEW QUESTIONS.

What would DOS have been like if you could run applications, format floppies, and copy, view, move or delete files and directories with a single keystroke? How would people have felt about DOS if all the commands were in English instead of in a foreign language?

Would the typical PC user be as bitter? As frustrated? As confused? There's only one way to tell. Try DOS Partner, the only shell that requires no DOS knowledge to use.

To see how simple DOS could've been, pick up DOS Partner™ at a local software dealer such as Connecting Point, Egghead or MicroAge for under $100. Or for more information please call 1-404-992-4140.

DOS*partner*™

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CIRCLE 110 ON READER SERVICE CARD

PLAYING THE DOS SHELL GAME

Cut through the confusion and find the right DOS shell by deciding how knowledgeable a user you are, how knowledgeable you want to become, and how far away from the C: prompt you want to get.

by Bruce Brown

DOS shells live! When *PC Magazine* last reviewed products in this category more than three years ago ("DOS Shells Get Smarter," February 24, 1987), it wouldn't have been outrageous to assume that by now everyone would be using OS/2 Presentation Manager or *Microsoft Windows*—and DOS shells would be dead. Today, however, most of us are still living with plain, old, unadorned DOS in all its inscrutability. DOS 4.01's Shell program substitutes menu choices for command names that have to be remembered and typed, but that in itself is not a big enough step toward true user-friendliness. Plain and simple, DOS is too tough for beginners and too dumb for everyone else.

To find ways to make DOS easier to use for everyone from novice to expert, we've evaluated 14 DOS shells; perhaps we should call them 14 programs that can act as DOS shells. There is a surprisingly wide variety of products on the market today

PHOTOGRAPHY: JOHN WILKES

that include the classic DOS-shell functions of disk and file management, easy DOS command usage, and application launching. The confusion gets even worse when you consider the desires of different types of users, all of whom could benefit from using a shell. Beginners need simplicity and hand-holding and want to be protected from DOS. Expert users want speed and extra functions and often resent having to work through the very same menus that novices love. Intermediate users fall somewhere in the middle but are likely to want both convenience and extra functions.

Meanwhile, PC managers responsible for maintaining computers for other users want DOS shells with good menu-making capabilities, passwords, custom help screens, and assignable user rights (this last feature will keep some users from ever having to see a DOS prompt). People who travel with portable computers that lack hard disks want as much functionality in as little space as possible.

Not to worry. There's a DOS shell for everyone.

WHAT TO LOOK FOR

A good DOS shell must provide all of DOS's file and disk functions in an easier or more convenient way than does DOS itself, and it must have functions DOS doesn't include. Since most DOS commands involve file, directory, or disk operations, it's essential that DOS shells shine in that area, making it easier to organize and manipulate applications and the files they create.

Many of the shells we looked at have menuing functions that let you set up your own application menus, but we didn't evaulate products like Delta Technology's *Direct Access*, which was designed specifically as a menu generator. A few of the programs we tested can set up application menus automatically, identifying your programs anywhere on your drives as if by magic. These shells work by finding the executable files that start the applications, recording their locations, and putting them in menus often according to application category.

More than half of the programs have launch-and-load facilities that you can use to select a file from a directory listing, then automatically start the program that created it and load the file. Even the MS-DOS shell program lets you set up a table to associate file extensions with executable application programs (see the sidebar "The DOS Shell You'll Find in DOS").

FEATURES ABOVE AND BEYOND

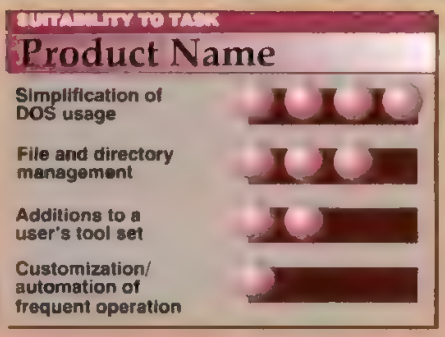
The list of additional features that some of these shells have is extensive. While some of the programs, notably *Q-DOS II* and *DOS Partner*, reflect their designers' preference to hold back on features to ensure that novices will not be overwhelmed or confused, others pile on every feature they can think of. The best example of the latter, by far, is *PC Tools Deluxe* 6.0.

There are also plenty of alternatives to commercial DOS shell programs. Many user-group bulletin board systems have public-domain DOS shells. There are several programs available on PC MagNet, including *Point-and-Shoot PC-FullBak* and *Magic Menu*, but we didn't review public-domain shells because they're subject to such frequent change. Two of the programs we evaluated, *PowerMenu* and *Treeview*, are available as shareware. You can try them for free; if you like them, send a registration fee to the vendor to get a manual, technical support, and upgrade alerts.

The range of features and user interfaces in these 14 programs is extensive. DOS shell preferences can be as subjective as keyboard choices, so as you read the reviews look for the functions you need and the style of operation that best matches your computing tastes. All of the programs we looked at worked as documented, and there isn't a truly bad choice in the lot. The differences are found in the shells' function sets, interface styles, and targeted users. Whether you're a beginner or an ex-

DOS SHELLS: SUITABILITY TO TASK

Which DOS shell gives you the specific features you need? *PC Magazine*'s suitability-to-task ratings offer one way to help you decide. These are systematic, though subjective ratings provided by our reviewers; for a more complete picture of what each product offers, compare these judgments with the information in the reviews and the features table.



THE TASKS

Simplification of DOS usage. Anything that helps beginners avoid having to manually enter DOS commands takes the edge off the often unfamiliar and demanding syntax. Menus, prompts, and aids that issue commands—complete with parameters—can save you time as well. Simplicity and intuitive program design are important, of course, and programs with multiple user levels deserve a gold star.

File and directory management. Shells that score well here have added functions that DOS doesn't or else they combine functions into fewer steps. Good file and directory management isn't just copying, deleting, and moving items. It also includes native file-format viewing without loading the application, rapid access to file and directory statistics, file search and sorting functions, and the ability to work with multiple disks.

Additions to a user's tool set. Does the shell have features like user and program passwords, usage logs, a DOS command history, or telecommunications and file-transfer modules, as well as its file and disk utility programs? Several of the programs can scan disks to find common programs and enter them into user menus, while some also allow you to point to programs to automatically run them and load files. Feature-heavy programs score well here.

Customization/automation of frequent operation. Here we evaluate a program's ability to customize or automate operations. To score well, a program should have macro and script languages, and tools that PC managers can use to set up menus and customize interfaces for less-experienced users.

THE RATINGS

0 = Lacking the feature or completely unsuited for the task.
1 = Poorly suited for the task.
2 = Somewhat capable.
3 = Well suited.
4 = Excellently suited. Your best choice for the task.

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CIRCLE 211 ON READER SERVICE CARD

pert, a DOS shell can bring greater convenience and productivity to your computing. The good news is that with such a wide variety of programs, you can get that convenience the way you want it.

ClassiFILE

by Bruce Brown

DOS isn't set up to tell you about directory and file contents. Its file and subdirectory naming limitations are barely enough to allow for discrete identifiers. If these limitations are holding you back, you should take a close look at SoftLogic Solutions' $89.95 *ClassiFILE*.

ClassiFILE is a file organization tool that also includes menu access to common DOS commands, a user-definable applications program and utilities menu, and a point-and-shoot capability to start programs and load files automatically.

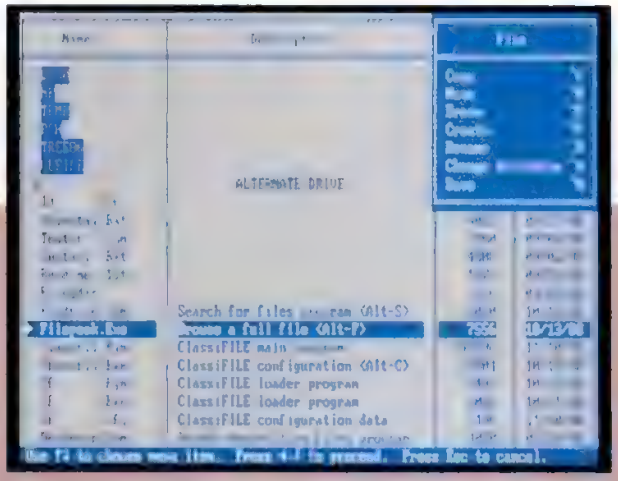
Suitable for minimal computer setups, 128K RAM is required to run the program in addition to DOS. The program files use 190K of disk space. When *ClassiFILE* runs other programs via its applications menu, it stays on the sidelines and takes up just 8K of RAM.

The most noticeable ways that *ClassiFILE* differs from DOS are its folders and descriptions. Folders are virtual headlines within a subdirectory under which you gather similar files (perhaps all those with a .BAT file extension) or files from one program. They cannot be nested, and all files that appear in a folder must be in the same subdirectory. Each folder has up to 13 character names and acts as a visual divider in *ClassiFILE*'s full-screen directory and file display. While they don't change the actual directory structure, folders do make it look better.

ClassiFILE's manual suggests that you keep several programs within the same subdirectory and organize them via folders, but with the threat of identical filenames, it isn't a great idea. Folders are a good alternative to subdirectories for storing groups of data files used for one application. In a word processing program directory, for example, you could keep memos, notes, and letters in separate folders based on projects or customers and restrict the program files to their own folder.

File descriptions of up to 35 characters is the second *ClassiFILE* tool worth noting. You don't need to write descriptions for each file, but if you do, 35 characters is ample space. Together with folder names and folder organization, *ClassiFILE*'s file descriptions let you annotate and organize your program and data files into visually logical and informative screens.

ClassiFILE's file and directory DOS-command aids are activated via pull-down menus or Ctrl-letter key combinations.



ClassiFILE's main screen is an extended directory that makes room for a 35-character comment or description. In this screen, *ClassiFILE* is displaying its own file descriptions, while a pop-up menu in the upper-right corner of the screen lists common DOS commands and the hotkeys used to implement them.

EDITOR'S CHOICE

- **Overall: PC Tools Deluxe**
- **Novice Users: Power Panel**
- **Power Users: Direc-Tree Plus, XTree Pro Gold**

The difficulty in selecting Editor's Choice products from this group of DOS shells is compounded by the variety of programs, as well as by the specific needs of DOS users with different levels of experience.

Our overall favorite is the jam-packed *PC Tools Deluxe* 6.0. The new version of this multiple category, award-winning program includes new tools and features just like you'd expect, but by adding three selectable user levels, *PC Tools* is now as desirable for beginners as it is for expert users.

Intermediate and power users will be well served by *XTree Pro Gold*. Its impressive collection of disk-, file-, and application-management features is unmatched. *Direc-Tree Plus* also gets a nod for requiring so little memory (35K), while being so full-featured. *PowerMenu* is best as a menuing program but gets honorable mention as a DOS shell for its security system and usage audit trail for project cost tracking.

Novice users have several good alternatives. The Editor's Choice goes to *Power Panel* for its comprehensive set of features and great interface. *DOS Partner* and *Q-DOS II* are both praiseworthy runners-up: *DOS Partner* for its intuitive interface and excellent manual, and *Q-DOS II* for its dedication to simple operations for beginners.

Three other programs deserve special mention. *The Norton Commander* and *PC-HookUP* both have data-transfer capabilities and other features that are good for desktop computers but especially suited for portables.

If you like the features mentioned in the evaluations but no one single program has the right mix, *HyperPAD* may be the best DOS-shell do-it-yourself kit yet conceived.

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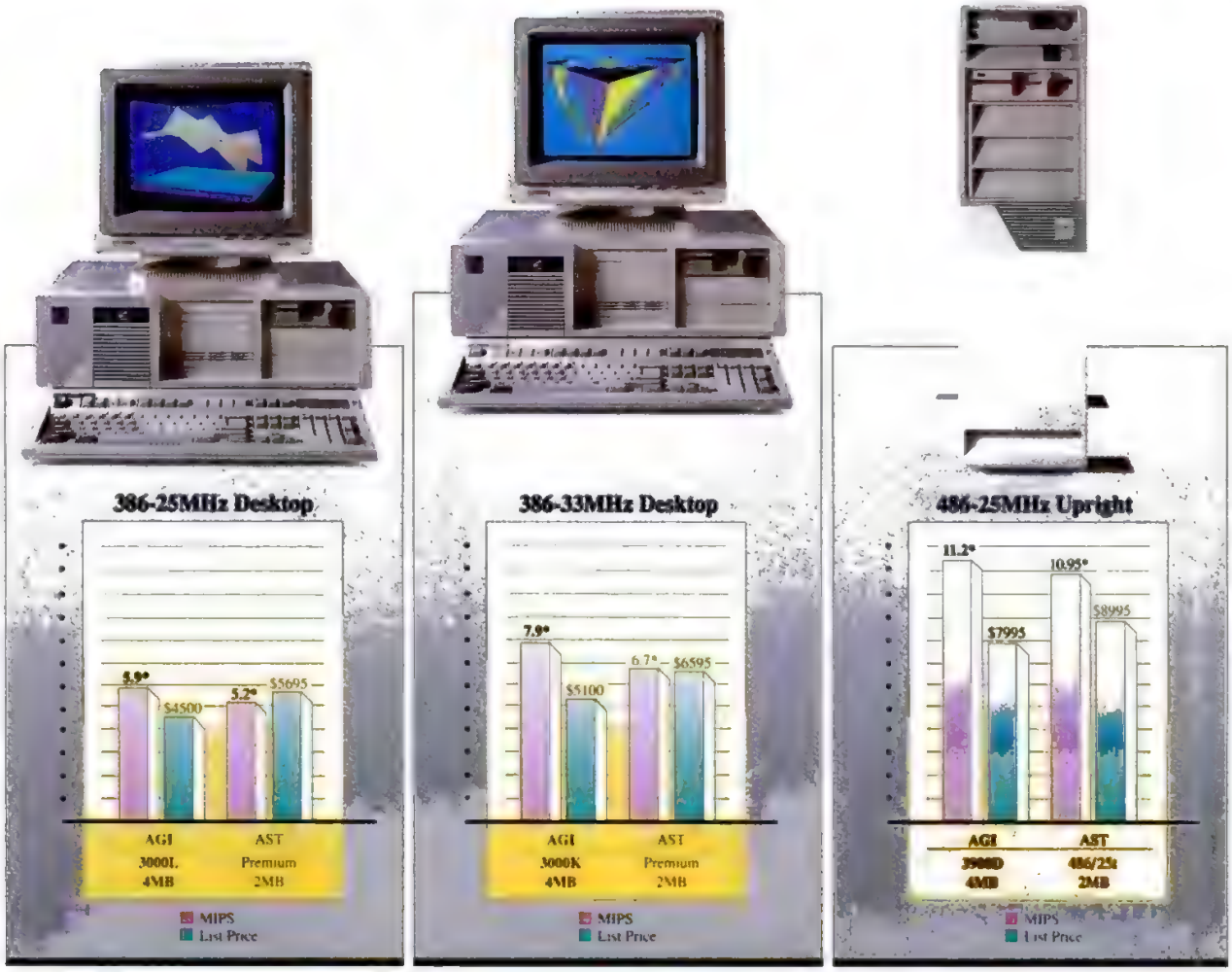

Sources: * Power Meter MIPs Version 1.5, The Database Group, Inc.

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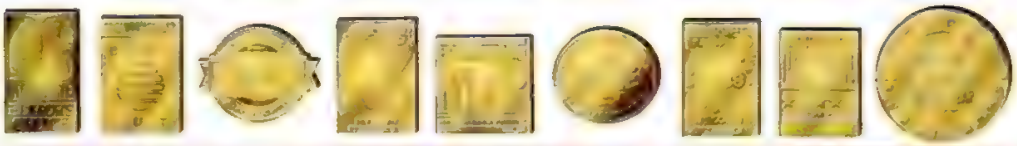

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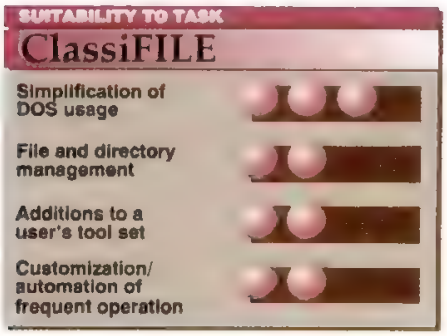
You can copy, move, erase, create, rename, change attributes, save, print, sort, and search for files; and you can make, change, and delete directories. File viewers are included for ASCII, hex, *WordStar*, *dBASE* format, and *Lotus 1-2-3* files. Other *ClassiFILE* utilities include disk and memory statistics, and a text editor.

CUSTOM CONFIGURED

There are two ways to customize *ClassiFILE*, but setup is best when left to more-experienced users. You can create a single key-applications menu via *ClassiFILE*'s configuration program in a process described as a prompted batch-file editor. You can also associate specific file extensions with individual applications to give you launch-and-load capability. You just point to a file, hit Enter, and both the application and the file are up and running.



ClassiFILE is best for beginning or average users, not for power users who'll probably find its folders and file descriptions a waste of time. For anyone who wants to add a personal organizational scheme beyond DOS's subdirectory structure and attach comments or descriptions to stored files, *ClassiFILE* is an interesting solution that includes DOS tools. The only caveat: novices might be daunted by the complex setups, even with the help of the better-than-average manual.

***ClassiFILE*, Version 1.0**
SoftLogic Solutions Inc., One Perimeter Rd., Manchester, NH 03103; (800) 272-9900, (603) 627-9900.
List Price: $89.95.
Requires: 128K RAM (256K recommended), DOS 2.0 or later.
In Short: *ClassiFILE* is a file-handling program designed specifically for the beginning or average user. It includes user-definable menus, 35-character file descriptions, point-and-shoot program execution, and a number of useful file-manipulation operations.

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SOFTWARE
DOS SHELLS

Direc-Tree Plus

by Tom Wigan

EDITOR'S CHOICE

Micro-Z bills its $49.50 *Direc-Tree Plus* DOS shell as "the perfect companion for your hard disk." This company has had a shell program on the market longer than almost any other in this roundup, and comes very close to delivering what it boasts.

Now in Version 5.4, *Direc-Tree* supplies an excellent installation program that lets you use the shell immediately or customize it to your specifications first. Installation is marred only by the inability to supply an alternative directory to *Direc-Tree*'s default directory. Nevertheless, once your installation is complete, you can copy the *Direc-Tree* files to any directory you choose.

The program is accompanied by thorough, straightforward documentation, as well as by context-sensitive help screens that guide you through *Direc-Tree*'s file-management procedures. When you first boot the program, eight lines at the bottom of your screen are covered by a pop-up help window that lists *Direc-Tree*'s basic keystroke commands. As you use the cursor keys to move the highlight bar from directory to directory, the pop-up window shifts position to give you the most advantageous view of the directory tree. You can toggle the help window off if you wish.

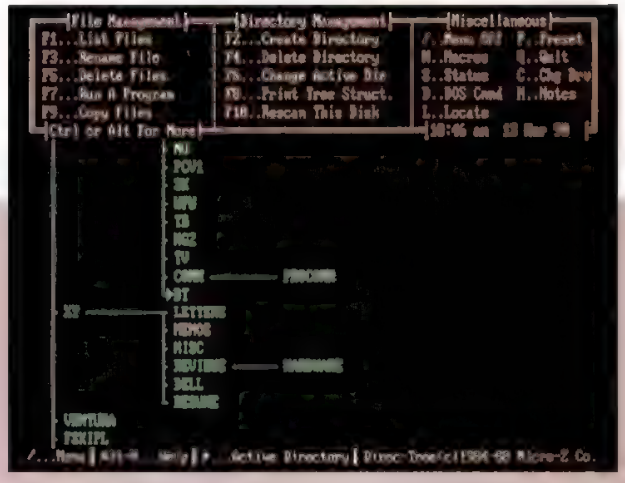
Like the other DOS shells evaluated here, *Direc-Tree* performs a variety of DOS functions via easy keystroke combinations. You can change directories by choosing a graphical representation from your disk's directory tree; you can view files in hex or ASCII formats; sort, move, rename, delete, and copy files, file groups, subdirectories, and whole directories.

Direc-Tree's keystroke combinations are user-definable, and you can program up to 100 macros accessible from a user-programmable "Preset Menu" that enables you to perform complex DOS operations or run programs. You can also shell out to DOS or applications.

Direc-Tree provides a facility to attach notes—up to 60 characters—to each of your DOS files. A pop-up status screen gives you the amount of file space left on your hard disk, the amount of free system RAM, and the time and date.

LEAVING OTHERS BEHIND

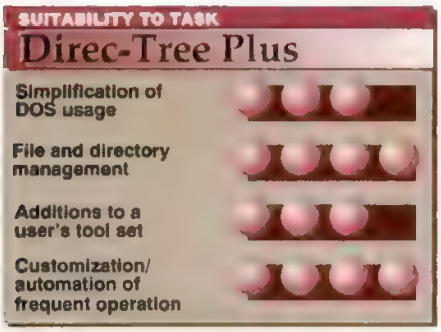
Where standard DOS-shell features stop, *Direc-Tree* truly starts to shine. The entire program takes only about 35K RAM, and you can configure *Direc-Tree* to unload most of itself from memory—all but about 5K—when you shell out to your word processor, database, communications package, DOS prompt, or any other application. I loaded and unloaded *dBASE IV* (a notorious memory hog) without a blip, and ran my word processor from *Direc-Tree* with *Lotus Express* chugging away in background mode. *Direc-Tree* allowed me to manage my files with system memory to



Direc-Tree Plus's comprehensive pop-up help menu lists most of the shell's keystroke macros and commands. If you're a veteran *Direc-Tree* user and know what you're doing, you can toggle the help menu off—you'll still have easy access to the program's full complement of handy features.

spare. This excellent, well-designed memory management scheme, if nothing else, puts *Direc-Tree* among the leaders for true ease of use.

But why stop there? Suppose you don't want to wait for your word processor to load; *Direc-Tree* includes its own *WordStar*-compatible editor. While the archaic *WordStar* mnemonic commands take time to remember, the word processor made short work of editing simple ASCII files—CONFIG.SYS, AUTOEXEC .BAT, and the like.



Yet another excellent feature is *Direc-Tree*'s *Securi-Tree*, a program that works within *Direc-Tree* and allows you to secure individual or groups of directories. Once a directory is secure, it cannot be accessed without the proper password. Up to 12 different directory groups can be secured and then supervised by a manager with access to all of them.

Is *Direc-Tree* really perfect? Not quite. The program does include drivers for PC-Mouse, Microsoft, Logitech, and Genius mice, but you won't find any mention of them in the documentation. Instead, you'll have to follow the instructions for their installation in an assortment of README .DOC files located on the distribution disk. And while easier mouse compatibility would add even greater convenience to this versatile, application-friendly DOS shell, it's still a front-runner for power users who need memory and flexibility.

***Direc-Tree Plus*, Version 5.4**
Micro-Z Co., 4 Santa Bella Rd., Rolling Hills, CA 90274; (213) 377-1640.
List Price: $49.50.
Requires: 64K RAM, DOS 2.0 or later.
In Short: A DOS shell with all the right stuff, *Direc-Tree* gives you not only a full complement of DOS-prompt-bashing macros, but superior memory handling, its own text editor, and a solid security scheme as well. It makes DOS easy for beginners and experts alike.

CIRCLE 606 ON READER SERVICE CARD

SOFTWARE
DOS SHELLS

DOS Partner

by Bruce Brown

If you've been confused by all the DOS-shell programs that offer features you don't understand or know if you need, you may want to look into EasySoft's $99 *DOS Partner*. The program is strictly targeted at DOS beginners, and everything about it reflects its single-purpose design.

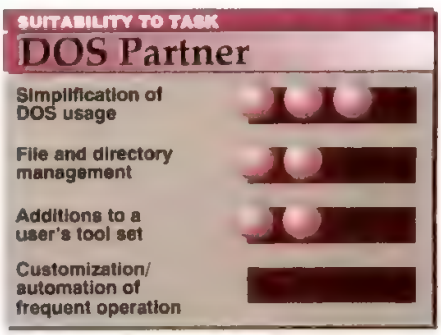
To begin with, installation is easy and automatic, and the menu system could be more intuitive only if the program came with a hand that pushed the keys for you. The manual is clearly written, well-organized, and beautifully designed.

You won't be surprised to learn that a beginner's program like this doesn't offer all the features of some of its competition. It automatically sets up applications in menus, displays menu selections for common disk- and file-related DOS commands, and offers a moderately flexible file viewer and screen saver. It also provides a system in which files within each directory are sorted into separate virtual folders by their filename extensions. But that's it. Don't look here for power tools, password systems, desktop accessories, or other special features.

For its limited feature list, *DOS Partner* takes up a hefty amount of RAM: 300K. It does drop down to 6K when running applications, however. Other system requirements include a hard disk, and either a keyboard or a mouse for program control.

One advantage is that you can use *DOS Partner* with any video setup; its graphics are all DOS-text based. When it comes to color, you can customize your display by choosing from selections such as All-American Colors, Tasteful Variety of Colors, Southern Gray Colors, and Christmas Colors.

DOS Partner can recognize more than 300 popular applications and put them in menus without any help or input. If you have programs it misses, all you have to do is enter the name you want to appear on the menu with the filename and extension of the executable file in the Teach Applications screen. You don't even have to specify the path, except for the drive name, because *DOS Partner* searches the disk to locate the executable file.



The Drive Management and File Management choices from the main menu show on-screen graphic representations of your system's disk drives. Under Drive Management, your only choices are to ob-

DOS Partner's File Management screen lists directories in the center with applicable commands on the bottom. Notice that *DOS Partner* also creates "folders" that sort files by filename extension. When you Open a directory or folder, *DOS Partner* lists the files within that directory and gives you the option of viewing files.

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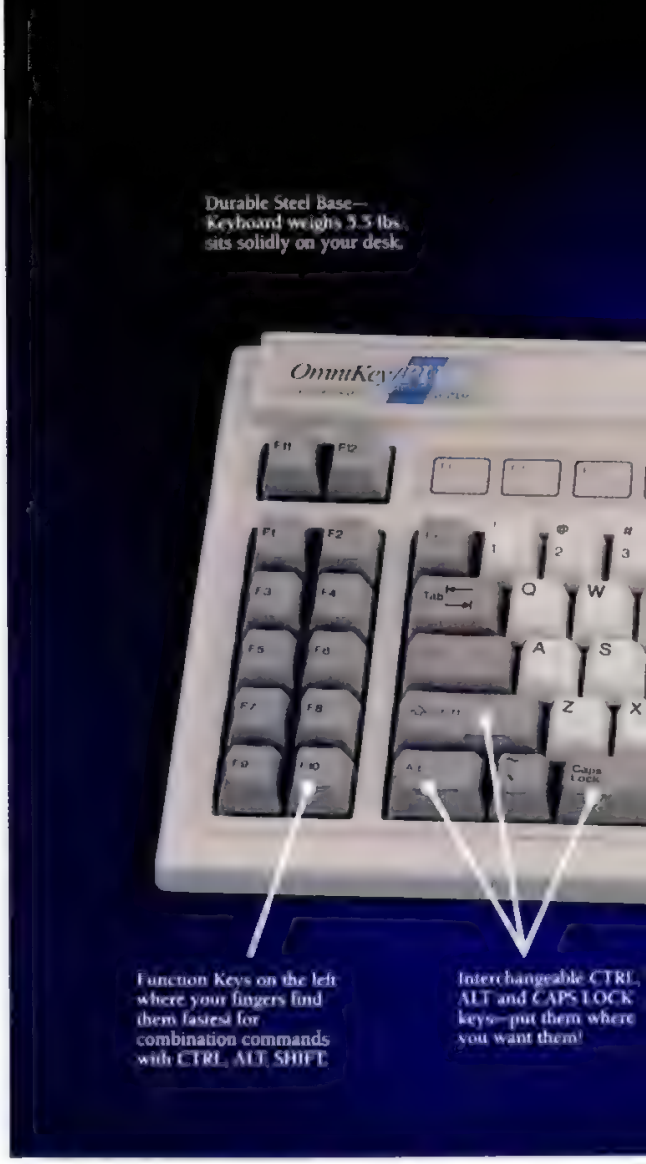

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Model #101-I—Many people have become accustomed to the standard IBM layout with F keys on top, inverted T cursor layout, etc. For you, we've duplicated ... well, nearly ... the IBM layout, but with a couple changes that improve on IBM

IBM puts BACKSLASH near BACKSPACE and ENTER keys. By doing so, they must reduce the size of one of the two keys.

Northgate believes the BACKSLASH key is better located on the bottom row next to the righthand SHIFT key. By placing it there, our layout gives you both a double wide BACKSPACE and large L-shaped ENTER key. We believe you'll prefer our layout. If not—send it back!

Model #101-N—Northgate's improvement over the standard IBM. Distinguished primarily by the independent Cursor Pad with diamond-shaped arrow layout. Independent numeric keypad with all the operands grouped around the numbers for faster numeric entry and commands.

More features! ESCAPE Key is positioned next to #1. Plus, we added an asterisk key on bottom row to speed wildcard commands. Includes Comma/Period lockout feature AND adjustable cursor rate capability

STANDARD FEATURES ON BOTH MODELS:

- Size: 18½"L x 7"W; IBM's 101 is 19⅜"L x 8⅜"W
- 12 F keys across the top
- Alps Click/Tactile Switches
- Switchable CTRL/CAPS LOCK
- PS/2 Compatible w/Adaptor

New small footprint!

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Original Northgate design with function keys on the left!

The first keyboard to get back to the basics with 12 function keys on the left. A modification most people prefer!

Two separate keypads! One IBM style inverted T for cursor control; second for numeric entry functions.

Custom convenience feature! See the control and left caps lock keys? They trade places. Put the CAPS LOCK in the third row right next to "a" key, if you prefer.

Non-skid design. *OmniKey*/102 has a heavy steel base for durability. Weighs 5.5 lbs.—won't slide around no matter how fast you type!

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There are some 500 *OmniKey* dealers nationwide. Call us and we'll give you the phone number of the one nearest you. If that's not convenient, order directly from Northgate!

You'll quickly agree Northgate *OmniKey* Keyboards live up to every claim we make. Use it for 60 days. And if you're not 100% satisfied in every way, return it for a full refund including ground freight.

And Remember: Your *OmniKey* Keyboard is backed by the industry's strongest warranty—FIVE FULL YEARS!

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HOURS: Mon.-Fri. 7 a.m. - 8 p.m.; Sat. 8 a.m. - 4 p.m. Central. Fax Your Order! 612-476-6433. For Dealer and Distributor Program Pricing, Phone Keyboard department at 612-553-0734. **Notice to the Hearing Impaired:** Northgate now has TDD capability. Dial 612-476-6958.

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tain drive statistics or to copy the whole drive.

The File Management selection lets you choose directories, file extension folders, and work your way down to the single file level. You can copy, rename, move, delete, and get statistics at the directory and folder levels and view, move, copy, delete, rename, and get statistics for files. *DOS Partner*'s file viewing works with ASCII, *WordStar*, *WordStar 2000*, *WordPerfect*, *XyWrite*, *Volkswriter*, *Professional Write*, *Lotus 1-2-3*, *Symphony*, and *Quattro* formats. The lack of database-manager file formats indicates EasySoft's relatively accurate estimation that beginners don't use databases or that those who do, don't need *DOS Partner*.

If you're a beginner, you grow out of *DOS Partner* after you gain some experience, but you'll have *DOS Partner* to thank for taking you so far—this is one program that hits the mark directly in its aim to help novices understand DOS.

***DOS Partner*, Version 1.1**
EasySoft Inc., 1215 Hightower Trail, #B100, Atlanta, GA 30350; (800) 526-6201, (404) 992-4140.
List Price: $99.
Requires: 300K RAM (512K recommended), hard disk, DOS 2.0 or later.
In Short: *DOS Partner* is for beginners. If you don't know or care about DOS, this is the program for you. The features, tailored for novices, include graphic representations of disk drives, mouse support, and an excellent manual. Power users should look elsewhere.

CIRCLE 607 ON READER SERVICE CARD

WHICH DOS SHELLS ARE READY FOR THE ROAD?

by Bruce Brown

DOS shells aren't just for desktop PCs. They can be as effective on the road as they are in the office, especially if they help you communicate.

Think about a good notebook-style laptop like the Toshiba T1000SE equipped with a 2MB silicon RAM card and an internal modem. This 6.2-pound machine equips the intrepid traveler with a good screen and keyboard, an internal 3.5-inch 1.44MB floppy disk drive, and one parallel port and one serial port in addition to the modem. Since the T1000SE comes standard with 1MB RAM and DOS is in ROM, this configuration gives you 2.4MB of storage above DOS's 640K and still leaves the floppy disk drive free.

The scenario we considered was one in which a traveler uses one full-powered DOS application that by itself needs no more than 1MB of disk storage space (such as *WordPerfect* 5.0, *dBASE III Plus*, or *Lotus 1-2-3* 2.01, each of which fits if you don't use some of the nonessential files). We then required .5MB of space for data storage (word processing documents, spreadsheets, data files). With the T1000SE equipped as above, you'd still have 800K or more of RAM for a DOS shell program, for other smallish programs or utilities, and perhaps even more room for data storage.

THE IMPORTANT EXTRAS

A telecommunications module is a big help for those who keep in touch or need to submit or download files while traveling. Data transfer, preferably in a more-convenient manner than hardwiring two computers together and using normal communications software, is another great advantage.

The need for additional goodies is more individual; spreadsheet users might want a shell with a text editor, while a calculator might be a plus for word processing users. One file utility with potential for on-the-road use is basically a set of file viewers that lets you see file contents created by other programs in their native format—a great advantage when you don't have the programs with you.

Of course, there are programs made specifically for portables, such as *WordPerfect Executive*, a low-end integrated package with its own DOS shell and application menu features, and Contact Software's *ACT!*, the sales professional's dream with its built-in memo writer, expense tracking, and phone dialer. For our purposes, let's look at the DOS shells evaluated here.

First we eliminate programs that require a hard disk or that simply take up too much space. Some of the larger programs, like *PC Tools Deluxe*, would be great on the road, but they're too big for easy traveling.

If you don't need telecommunications or data-transfer capabilities, *ClassiFILE* and *Tree86 Plus*, two programs that simplify DOS, help manage files, and assist in running applications are good choices. *ClassiFILE* requires only 190K storage space and includes a minimal text editor. *Tree86 Plus* fits in 280K including the caching program and it, too, includes a text editor.

Two programs offer an excellent utility for notebook computer users who want to send files to others both by phone and by cable: *PC-HookUP* and *The Norton Commander*. *PC-HookUP* fits in under 170K of space and includes a text editor, a regular telecommunications module, and its namesake data-transfer function. For the $129.95 list price you also get a heavy-duty six-headed cable to connect to 9-pin or 25-pin serial ports or parallel printer ports for high-speed data transfer. For its minimal disk storage requirement and heavy value, look to *PC-HookUP*.

The Norton Commander needs over 800K for its standard installation, but it comes with many file-format viewers, each of which takes up 50K or more. With some judicious selection you can get down or at least close enough to our 500K DOS shell limit to make this a fine candidate for notebook users. *Commander* includes a menu facility, a text editor, and a helpful set of DOS and file-assistance tools. In addition, it has *Commander Mail*, a telecommunications module specifically set up to work with MCI Mail, and *Commander Link*, a data-transfer utility that, with an optional $29 null-modem cable, lets you exchange files with another PC.

If you don't have the luxury of 2MB or more of RAM above DOS's 640K, you'll be limited to the smallest programs that can fit on a floppy disk and still leave room for application or data files (such as *PC-HookUP*). With both *PC-HookUP* and *The Norton Commander* installed in hard RAM, however, you'll be able to manage DOS and data files conveniently and have their added data-transfer and telecommunications features. ■

In 1989, PC Tools™ was the most talked-about utility software.

Central Point Software INC™

Introducing PC
The utility they'll be t

Disk Backup

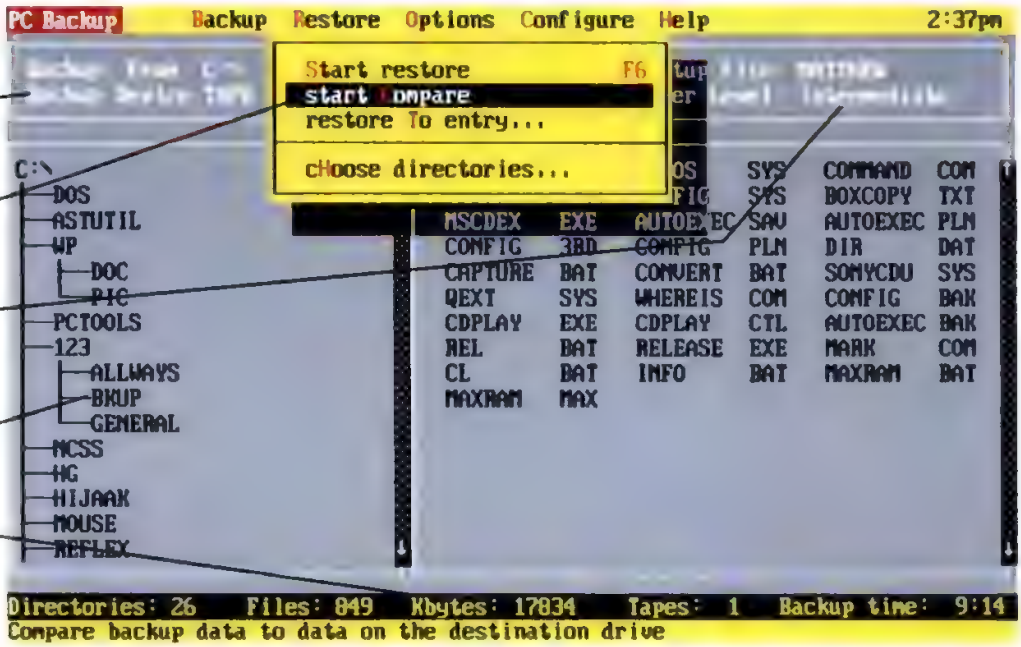
NEW ***Supports tape drives*** *used by IBM, Compaq, Irwin, Mountain and others. Features unattended, scheduled backups.*

NEW ***Advanced error-checking and correction*** *make sure your backup is absolutely reliable.*

NEW ***With three user levels,*** *begin with the basics and add more features when you're ready. Optional password protection. (Also included in PC Shell,™ below.)*

Quick, easy file selection. *Pick the files or directories you want and save your selections in a file for use later.*

NEW ***Fast and economical.*** *Backup at speeds up to 2.5 MB per minute. Our new high-speed compression reduces disk/tape usage up to 60%*



DOS Shell

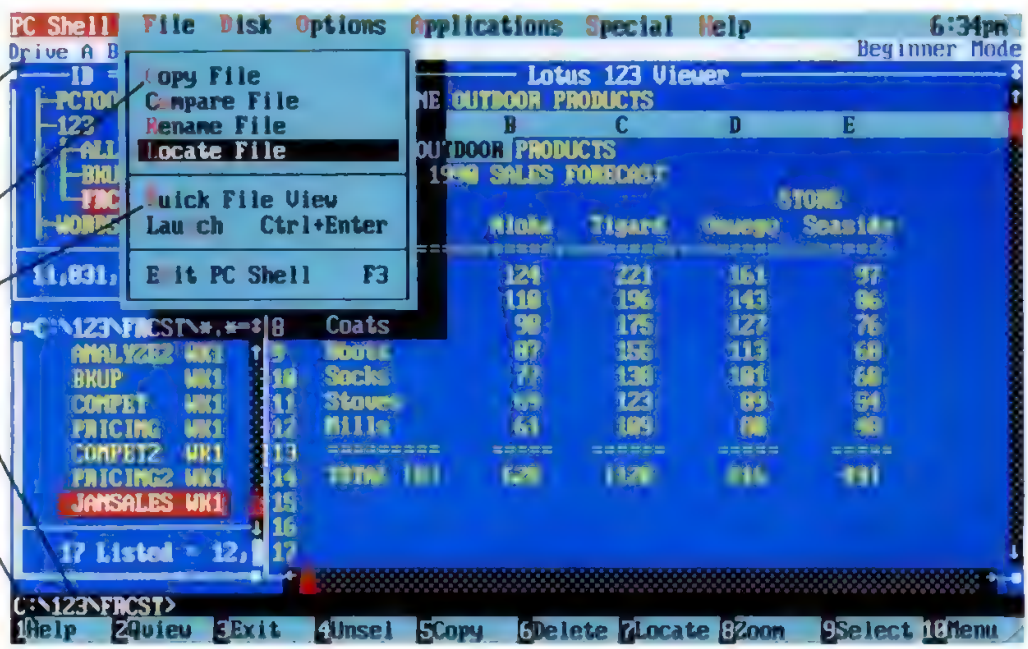
Network support. *Working with files on Novell and IBM PC LANs is as easy as if they were right inside your PC.*

NEW ***Transfer files to your laptop*** *with a built-in version of LapLink from Traveling Software.*

NEW ***Over 30 file viewers*** *let you browse through an entire directory of files in a matter of seconds.*

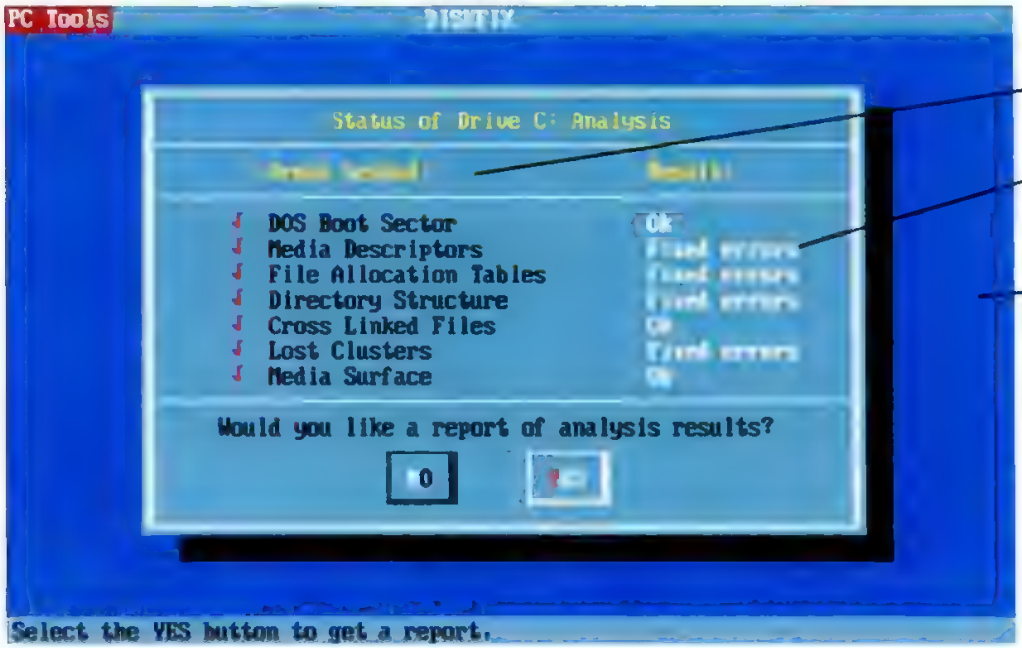
NEW ***Resident DOS prompt.*** *Hot-key into PC Shell and execute any DOS command without leaving your main program.*

NEW ***With user-definable function keys,*** *any of PC Shell's 60 functions are within easy reach.*



In 1989, PC Tools established itself as the world's leading utility product, not only by selling 711,000 copies, but also by receiving nearly every editorial award possible in its class. This year, we're proud to announce PC Tools Deluxe Version 6–more than 70 new features that set new standards for technical depth and ease of use.

Tools™ Version 6.
alking about in 1990.



Data Recovery

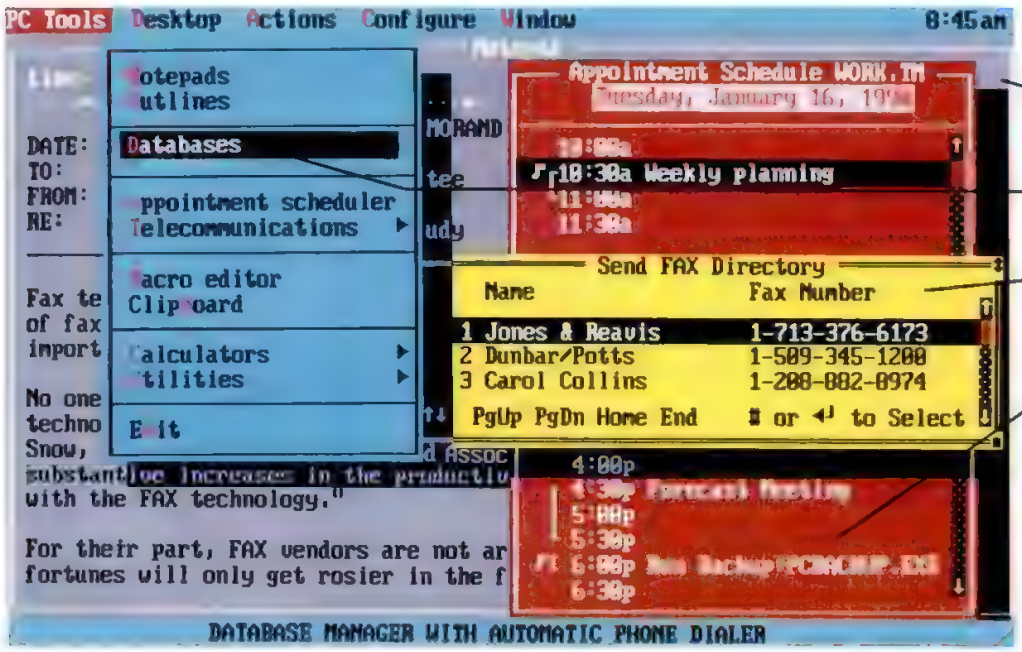
NEW ***Powerful and complete.*** *DiskFix™ is the most comprehensive disk-repair program you can buy.*

NEW ***Simple and automatic.*** *DiskFix analyzes and repairs disks on its own. It doesn't ask you to become an expert.*

NEW ***Fast.*** *DiskFix performs over 1,000 tests on a 32 MB partition in as little as six seconds.*

Undelete and unformat *functions provide fast, easy recovery from deleted files or accidental formats.*

To speed recovery, *our Mirror program takes regular snapshots of your partition table, FAT and directory.*



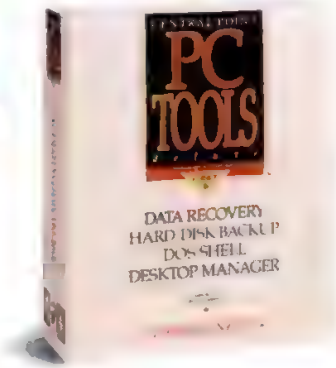
Desktop

Twelve integrated applications, *available on demand. Uses only 40 KB RAM in resident mode.*

NEW ***Our dBASE-compatible database*** *lets you manage lists, create form letters or autodial calls.*

NEW ***Fax support.*** *With a fax board you can send an urgent document anywhere in the world. Works over networks.*

The scheduler *not only tracks appointments, but can do a backup or download e-mail at a predetermined time.*



So discover Version 6 for yourself: Use the attached card to request more information or upgrade from a previous version. And get the utility they'll be talking about in 1990.

Central Point Software INC.™

PC Tools™ is the most powerful collection of data recovery, hard-disk backup, DOS shell, and desktop manager programs available–at any price. ★ Indicates new or improved in Version 6.

CONSISTENT INTERFACE

★ NEW! **VARIABLE USER LEVELS.** Beginner, Intermediate, and Advanced modes for PC Backup and PC Shell.

- **EASY TO USE.** Pull-down menus, context-sensitive help, full mouse support. Movable, resizable windows. IBM SAA/CUA compliant.

DATA RECOVERY

★ NEW! **DISKFIX.™** The most comprehensive disk-repair program available. Quickly and automatically diagnoses and repairs lost or cross-linked files and directories, file allocation errors and corrupt directory/partition information.

- **UNDELETE.** Fast and easy recovery of deleted files and subdirectories.
- **UNFORMAT.** Recover data after an accidental or unintended format.

HARD DISK BACKUP

★ NEW! **TAPE DRIVE SUPPORT.** Backup to QIC-40, QIC-80, and Irwin tape drives from IBM, Compaq, Mountain, Colorado Memory and Archive (QIC-80 only). Record up to 250 MB on one tape.

★ NEW! **COMPARE.** Checks backup against current files–produces report of differences.

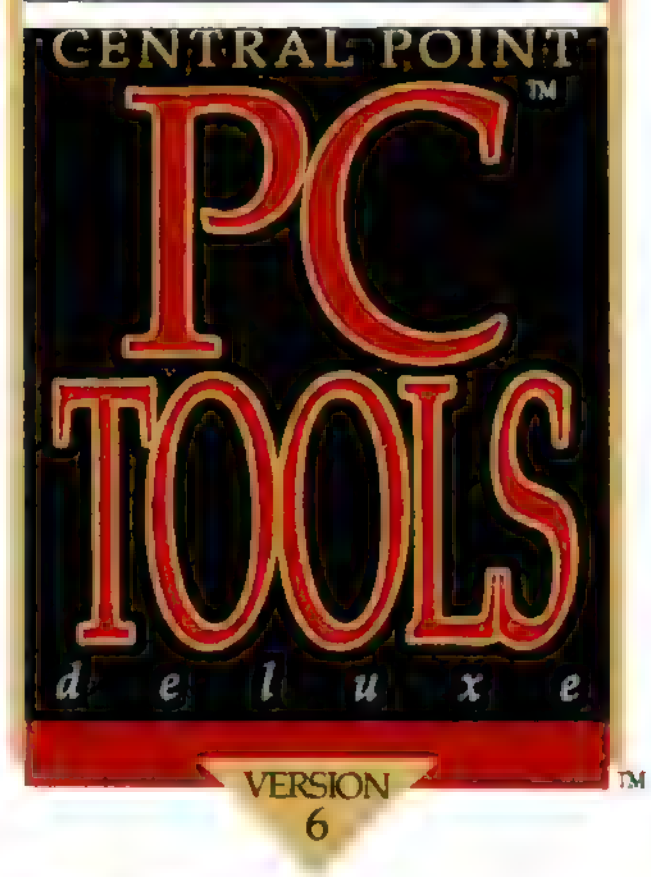
★ NEW! **APPENDED BACKUPS.** Allows full and incremental backups to be retained on a single set of disks/tapes.

★ NEW! **FAST BACKUP.** Backup at speeds up to 2.5 MB per minute or faster, depending on your CPU speed.

★ NEW! **STANDARD DOS FORMAT.** Backup disks are now readable by DOS. Saves time and allows re-use of media without formatting.

★ NEW! **ADAPTIVE DATA COMPRESSION.** High-speed compression reduces disk/tape usage by up to 60%.

- **RELIABLE BACKUP.** Complete bit-for-bit verification of all data backed up; can reconstruct missing data from damaged disks.
- **SCHEDULED BACKUPS.** Schedule backups to run automatically.
- **DISK/TAPE/TIME ESTIMATE.** Dynamically estimates disk/tape and time usage for backup.



DOS SHELL

★ NEW! **OVER 30 FILE VIEWERS.** Quickly view files in their native formats. (See list below.)

★ NEW! **LOCATE.** Locate your files by name or by content; then load selected data and its parent application in one step.

★ NEW! **RESIDENT DOS PROMPT.** Hot-key into PC Shell and execute any DOS command without unloading your main program.

★ NEW! **FILE TRANSFER.** Transfer files to a laptop via serial cable with an integrated version of LapLink from Traveling Software.

★ NEW! **PROGRAMMABLE FUNCTION KEYS.** Customize PC Shell's function keys for quick access to your most-used commands.

- **FAST, EASY OPERATION.** Invoke standard DOS commands (Copy, Rename, Delete, etc.) with just a single keystroke.
- **SORT, MOVE, PRUNE & GRAFT.** Reorder and reorganize files and directories with ease.

FILE VIEWERS

WORD PROCESSORS
- WordPerfect
- MS Word
- MS Works
- Wordstar
- Wordstar 2000
- XyWrite
- Multimate
- MS Windows Write
- PC Tools Notepad
- ASCII Text

SPREADSHEETS
- Lotus 1-2-3 (1A, 2.X)
- Symphony
- MS Excel
- MS Works
- Quattro
- Words and Figures
- Twin
- VP-Planner Plus

DATABASES
- dBASE III, IV
- Paradox
- R.Base
- FoxBASE
- Clipper
- dBXL

OTHER
- Binary
- PC Paintbrush (PCX graphics)
- ARC, LZH, PAK, PKZIP and ZOO catalogs

- **NETWORK SUPPORT.** Supports Novell and IBM PC LAN networks.
- **MEMORY RESIDENT.** Optionally loads memory-resident. Use on top of other applications. Requires only 10 KB RAM.

DESKTOP MANAGER

★ NEW! **FAX SUPPORT.** Use an Intel, Spectra or other CAS-compatible fax board to send/receive faxes at any time. Supports networks.

★ NEW! **DATABASE.** dBASE file-compatible; lets you manage lists, create form letters or autodial calls. Includes indexing, append/transfer, field-editing and a browse mode.

★ NEW! **TELECOMMUNICATIONS.** Send faxes or e-mail through services such as MCI, Compuserve, and EasyLink. Easily add other services. Can run in background.

★ NEW! **CALCULATORS.** HP-11C scientific, HP-12C financial, HP-16C programmer's, and algebraic calculators.

- **NOTEPADS.** Includes spelling checker, block moves, search/replace, and more.
- **APPOINTMENT SCHEDULER.** Plan and prioritize your schedule. Do a backup, send a fax, or download e-mail at a predetermined time.
- **CUT AND PASTE.** Capture work from your screen and "paste" it into a different program.
- **MEMORY RESIDENT.** Optionally loads memory-resident. Use on top of other applications. Requires less than 40 KB RAM.

OTHER FEATURES

★ NEW! **PC CACHE.** Increases system performance. Includes optional write-caching. Supports conventional, extended and expanded (EMS) memory.

- **COMPRESS.** Unfragments files to speed disk access.
- **PC SECURE.** Password protection for sensitive data and program files; encrypts data to U.S. Department of Defense (DES) standards.

REQUIREMENTS

IBM PC, XT, AT, PS/2 or 100% compatible with DOS 3.0 or higher and 512KB RAM. Hard disk recommended. Supports Microsoft mouse driver version 6.14 or higher, Logitech/Dexxa mouse drivers version 3.4X or higher, or 100% compatible.

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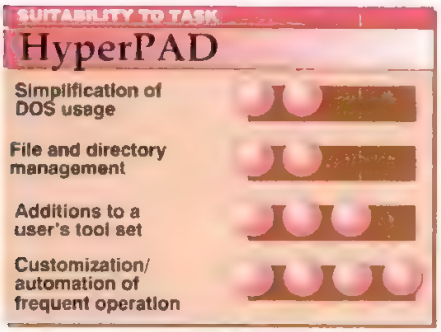
HyperPAD

by Bruce Brown

If you want a DOS shell but aren't satisfied with anything you've seen, Brightbill-Roberts' *HyperPAD* may be just what you are looking for. This $149.95 custom development tool lets you set up your own DOS environment controller or interface, or design a front end for any other application you wish. *HyperPAD* combines deceptively simple development tools with a powerful scripting or programming language.

HyperPAD isn't a DOS-shell program itself, but it does come with one. We included *HyperPAD* in this feature for two reasons: what it has and what it can do. It comes with a set of predesigned "PADS" that include many desirable file- and disk-management tools and other desktop utility programs. *HyperPAD* is also beautifully suited for creating your own DOS shell, either by modifying the existing PADs or starting from scratch.

The preprogrammed PADs were included with *HyperPAD* to show the potential of the program and so that people can learn how to work and possibly think in a *HyperPAD* environment. There are 12 PADs, including one called the DosPAD. The DosPAD doesn't use graphic directory trees, but it does include several directory functions such as file tagging for multiple file copying, moving, and deleting. You can also create and delete directories and use copy, move, and delete functions for whole directories, subdirectories and their contents. You can search a drive by name, but the DosPAD doesn't include wildcard searching support or searching for character-string matches in files.



If you want a DOS shell to help start applications, *HyperPAD* makes a lot of sense. From one perspective, creating custom menus is what this program is all about. You can start programs from menus and also set *HyperPAD* to start applications automatically when you point to and select applications files; a process often referred to as launch and load. You can also password-protect menu items to restrict access.

EXTRA UTILITIES

Other features in *HyperPAD*'s PADs include a calculator, notepad, name and address list, daily planner, and a card file. You can use it to compress files, and there's a moderately powerful telecommunications module that you can use as a phone dialer. You can also customize via *HyperPAD*'s advanced script language to automate regular telecommunications tasks.

The selection of predefined functions in *HyperPAD* is okay, but if that were all you could do with the program, we'd say, "Easy to use but limited; too costly for what you get." However, don't forget that the predefined PADs are just samples. *HyperPAD*'s greatest value is as a not-so-secret weapon.

HyperPAD is widely touted as bringing the best of the Apple Macintosh world to the IBM-compatible world. If you associate with Macintosh users, you may have become bored with the talk about *HyperCard* and card stacks. Mac users often gush about the greatness of *HyperCard*—great, meaning easy to use and flexible enough to handle any information you can display on a computer screen. Interestingly enough, and of special significance for this review, many of the people who are most enthusiastic about *HyperCard* are nonprogrammers—computer beginners enticed by *HyperCard*'s capabilities.

PROGRAMMING LANGUAGE

While IBM users have had macro recorders and programmable function keys, until *HyperPAD* we had nothing like *HyperCard*. Essentially *HyperPAD* is an object-oriented development tool accompanied by a powerful scripting (programming) language.

HyperPAD is an applications development tool well-suited to designing user menus and interfaces. In this screen, *HyperPAD*'s DOS PAD lists drives, directories, files, and PAD-specific DOS command buttons. You can use the DOS PAD as it is, change it, or create your own by using *HyperPAD* as a programming tool.

You can use *HyperPAD* in five modes: Browsing, Typing, Painting, Authoring, and Scripting. In Browse mode you look through PADs and activate programs or functions via PAD "buttons." In Type mode you can add, move, and copy information. In Paint mode you can alter the appearance of pads with drawing and coloring tools, as well as import files from other drawing programs. At the Authoring level you control how buttons work and make connections between various program and PAD features.

HyperPAD's highest level, Scripting, uses a programming language called PADTalk which, like Apple's HyperTALK, is a high-level language with commands, functions, fixed and variable values, and operation-flow control structures. If you never use PADTalk directly (it controls the

DOS SHELLS: SUMMARY OF FEATURES

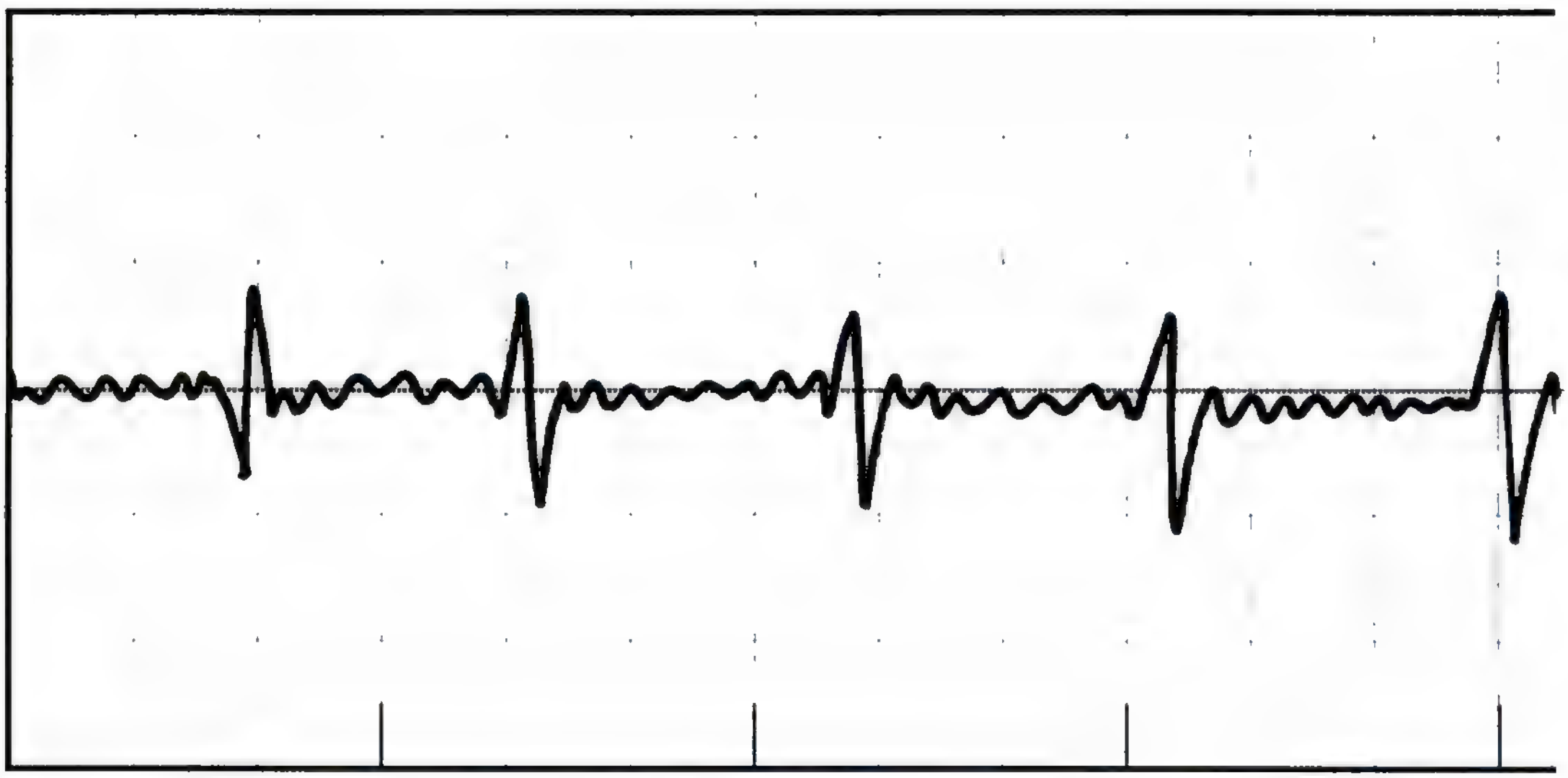
Products listed in ascending price order

	Direc-Tree Plus	Treeview	Power Panel	Q-DOS II	ClassIFILE	PowerMenu	Tree86 Pl
	$49.50	$50.00	$69.95	$79.95	$89.95	$89.95	$89.95
SYSTEM ENVIRONMENT							
Works on networks	■	■	Optional ($299)	Optional ($399)	■	Optional ($750)	■
Uses expanded memory	⌟	■	❑	❑	■	⌟	■
Uses extended memory	⌟	⌟	⌟	❑	⌟	⌟	■
Runs in resident mode	■	■	■	■	■	■	■
RAM required	5K	15EK	94 bytes	128K	EK	2 4K	5K
Runs as TSR	⌟	⌟	⌟	❑	⌟	⌟	⌟
RAM required	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Auto-install	■	⌟	■	■	■	■	⌟
INTERFACE							
Center-screen menus	■	⌟	■	⌟	■	■	⌟
Top-line menus	■	■	⌟	■	⌟	■	■
Bottom-line menus	■	⌟	⌟	⌟	■	■	⌟
Icons	⌟	⌟	⌟	⌟	■	⌟	⌟
Pop-up menus	■	⌟	■	⌟	■	■	■
Pull-down menus	■	■	⌟	⌟	■	■	■
Supports mouse	■	■	■	⌟	⌟	⌟	■
Generic or ASCII output only	■	■	■	■	■	■	■
Number of printer drivers supplied	2	None	None	None	None	None	None
Can print to file	■	⌟	⌟	■	⌟	■	■
FILE MANAGEMENT							
Directory tree display	■	■	■	■	■	■	■
Copy directory or subdirectory	■	⌟	■	■	⌟	⌟	⌟
Delete directory or subdirectory	■	■	■	⌟	⌟	■	■
Move directory or subdirectory	■	⌟	■	⌟	⌟	⌟	■
Tag files for group actions	■	■	■	■	■	■	■
DOS commands:							
Attribute	■	■	■	■	■	■	■
Backup and restore	■	⌟	■	⌟	⌟	⌟	⌟
Compare	⌟	⌟	■	⌟	⌟	⌟	⌟
Format	⌟	⌟	■	⌟	⌟	⌟	⌟
Move	■	■	■	■	■	■	■
Print	■	⌟	■	■	■	⌟	■
Rename	■	■	■	■	■	■	■
Volume label	⌟	■	⌟	⌟	⌟	⌟	⌟
Xcopy	⌟	⌟	⌟	■	⌟	⌟	■
Sort files by filename	■	■	■	■	■	■	■
Sort files by date	■	■	■	■	■	■	■
Sort files by file size	■	■	■	■	■	■	■
Search for filename	■	■	■	■	■	■	■
Search for file contents	⌟	⌟	■	⌟	⌟	⌟	■
Wildcard searches	■	■	■	■	■	■	■
UTILITIES							
Runs applications from menu	■	⌟	■	⌟	■	■	⌟
Runs applications via DOS command line	■	■	■	■	■	■	■
Sets up file folders or directories	■	■	⌟	⌟	■	❑	⌟
Attaches comments to file	■	⌟	⌟	⌟	■	❑	⌟
Launch-and-load capability	■	■	■	⌟	■	■	■
Menu maker	■	⌟	■	⌟	■	■	⌟
Application switcher	⌟	⌟	⌟	⌟	⌟	❑	⌟
Memory map display	⌟	⌟	⌟	⌟	⌟	■	■
Text editor	■	⌟	■	■	■	❑	■
Print from text editor	■	N/A	■	■	⌟	N/A	■
File viewer	■	■	■	■	■	❑	■

⌟—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

DOS Partner	SoftBreeze	XTree Pro Gold	PC-HookUP	The Norton Commander	PC Tools Deluxe	HyperPAD
$99 00	$99.00	$129.00	$129.95	$149.00	$149.00	$149.95
■	☐	Optional ($299)	■	■	■	■
☐	■	☐	☐	☐	■	■
☐	■	☐	☐	☐	■	■
■	■	■	■	■	■	■
6K	31K	7K	12K	13K	10K	2K
☐	■	☐	☐	☐	■	☐
N/A	31K	N/A	N/A	N/A	10K--40K	N/A
■	■	■	■	■	■	■
■	☐	■	■	■	■	☐
☐	■	☐	■	■	■	■
■	■	■	☐	■	■	☐
■	☐	☐	☐	☐	☐	☐
■	■	■	■	■	■	☐
☐	■	☐	■	■	■	■
■	■	■	■	■	■	■
☐	■	■	■	■	■	☐
None	None	None	None	None	None	14
☐	☐	■	■	☐	■	■
☐	■	■	■	■	■	☐
■	■	■	■	☐	■	■
■	■	■	■	■	☐	■
■	☐	■	■	☐	■	■
■	■	■	■	■	■	■
☐	■	■	■	■	■	☐
☐	■	■	☐	☐	■	☐
☐	☐	☐	■	■	■	☐
■	■	■	☐	☐	■	■
■	■	■	■	■	■	■
☐	☐	■	■	☐	■	☐
■	☐	■	■	■	■	☐
■	■	■	☐	■	■	☐
■	■	■	■	☐	■	☐
■	■	■	■	■	■	☐
☐	■	■	■	■	■	☐
☐	■	■	■	■	■	☐
☐	■	■	■	■	■	☐
☐	☐	■	■	■	■	☐
☐	■	■	■	■	■	☐
■	■	■	☐	■	■	■
☐	■	■	■	■	■	☐
■	☐	☐	☐	■	■	☐
☐	■	☐	☐	☐	☐	☐
☐	■	■	☐	■	■	■
■	■	■	☐	■	■	■
☐	■	☐	☐	☐	■	☐
☐	■	☐	☐	☐	■	☐
☐	■	■	■	☐	■	☐
N/A	■	■	■	☐	■	☐
■	■	■	■	■	■	☐

CONTINUES



This is what typically happens to people about

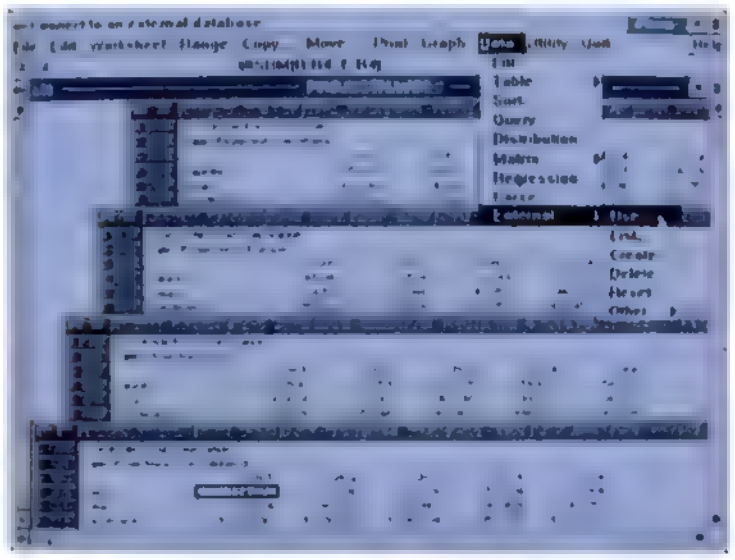
It starts almost immediately. You see menu commands you already know. Which, to a Lotus® 1-2-3® user, is a comforting sight. You use the familiar 1-2-3 keystrokes. No surprises there. You realize that it feels like 1-2-3 because it is.

But wait, there's a mouse. And pull down menus and dialog boxes and a WYSIWYG display. Which is where things suddenly start getting exciting.

Like 1-2-3 Release 3, 1-2-3/G™ offers true 3D worksheets, file-linking, direct access to external databases, and network support. And through its graphical user interface, plus a host of new features, 1-2-3/G becomes a powerful analytical tool that is extremely easy to use and responsive to the way you work.

You discover an exciting new feature called Solver, an advanced goal-seeking technology that gives you an amazing short-cut to solve complex "what-if" business problems. In seconds, Solver shows you "how-to" achieve your desired results, based on the variables and constraints you put into your spreadsheet.

And when you're ready to present your results, you'll find a variety of dramatic new graphing capabilities that will help you make your point with clarity and impact.



Whether it's working with a 3D file or bringing in information from external databases, the power of 1-2-3/G is always within reach.

Plus, 1-2-3/G takes advantage of the speed, large memory, and multi-

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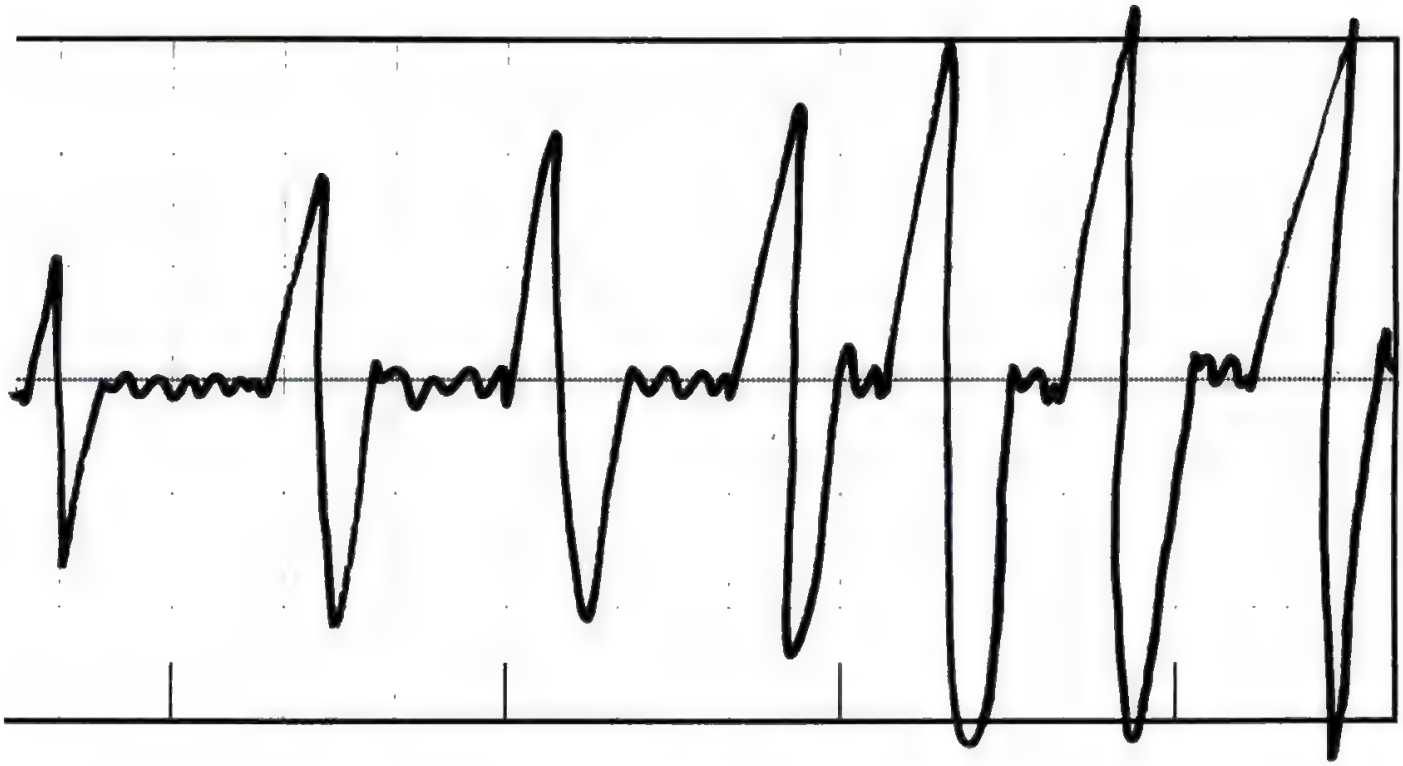

3 minutes into a 1-2-3/G product demo.

1-2-3/G allows you to look at your graphs and spreadsheets simultaneously, and lets you customize them with fonts, colors and borders.

tasking capabilities of OS/2®. And it supports Dynamic Data Exchange, enabling you to swap live data between 1-2-3/G and other OS/2 applications for true application integration.

Not surprisingly, 1-2-3/G received the Best Software Product award at its Comdex preview last fall. And PC World has called it a "new high in spreadsheet technology."

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Lotus 1-2-3/G

Call 1-800-842-8455
extension 166

Introducing the new Lotus 1-2-3/G

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If you're a current 1-2-3 user and would like a 1-2-3/G Upgrade Ordering Kit, please call 1-800-TRADE UP.

other four *HyperPAD* levels, but you don't see it), you can still get terrific value from *HyperPAD*. If you venture into PADTalk, you may be surprised to discover that programming doesn't have to be hard, though certainly PADTalk requires more thought and planning than using the other *HyperPAD* modes.

WHY HYPERPAD?

If you would like to set up your own DOS shell and want something more than what you can do with DOS batch files, but don't want to get into more complicated programming, *HyperPAD* is a possible solution. With its standard predesigned PADs *HyperPAD* provides you with a very good start—certainly enough to live with until you get used to working in the *HyperPAD* environment. If you start to experiment or get down to some serious design and implementation, *HyperPAD*'s strength and facility as an interface-design and programming tool will show through very clearly.

***HyperPAD*, Version 1.0**
Brightbill-Roberts & Co., 120 E. Washington St., #421, Syracuse, NY 13202; (800) 444-3490, (315) 474-3400.
List Price: $149.95.
Requires: 384K RAM, DOS 2.1 or later. Hard disk recommended.
In Short: *HyperPAD* is primarily an applications development tool that you can use to build your own DOS shell. A useful collection of prewritten "PADs" is included with the program, but *HyperPAD* shines because of its relative ease in setting up user interfaces and interactive systems. This program is not for beginners but if you have moderate programming skills and want to try some high-powered design experiments *Hyper-PAD* is for you.

CIRCLE 606 ON READER SERVICE CARD

The Norton Commander

by Bruce Brown

Why not let the commander take charge? If you understand DOS but are looking for convenience, Peter Norton Computing's *The Norton Commander*, Version 3.0, offers a variety of features unmatched by other shell programs. This $149 software package isn't the best DOS shell for beginners, but intermediate to expert users will find much to appreciate.

To use *Commander* you need at least 256K RAM since the program takes 178K during operation, dropping to 13K when it starts other applications. *Commander* takes over 800K of disk space, but you can cut back if you erase nonessential file-format viewers. If you don't have a hard disk but have enough memory, you can main-

DOS SHELLS: SUMMARY OF FEATURES

Products listed in ascending price order

	Direc-Tree Plus	Treeview	Power Panel	Q-DOS II	ClassIFILE	PowerMenu	Tree86 Plus
Formats	ASCII, hex	ASCII, hex	ASCII, hex	ASCII, hex	ASCII, *dBASE*, hex, Lotus .WK1, *XyWrite*	N/A	ASCII, hex
Graphics	ASCII high	None	None	None	None	None	None
Macros	■	■	■	❑	❑	❑	❑
Macro recorder	■	❑	❑	N/A	N/A	N/A	N/A
Macro editing	■	❑	■	N/A	N/A	N/A	N/A
Calendar	❑	❑	■	❑	❑	❑	❑
Schedule	❑	❑	■	❑	❑	❑	❑
Calculator	❑	❑	■	❑	❑	❑	❑
Telecommunications facility	❑	❑	■	❑	❑	❑	❑
Telephone directory	N/A	N/A	■	N/A	N/A	N/A	N/A
Auto-dialing	N/A	N/A	■	N/A	N/A	N/A	N/A
Auto-log-on	N/A	N/A	■	N/A	N/A	N/A	N/A
Terminal emulation	N/A	N/A	■	N/A	N/A	N/A	N/A
Script language	N/A	N/A	■	N/A	N/A	N/A	N/A
Can attach binary files	N/A	N/A	❑	N/A	N/A	N/A	N/A
Clipboard	❑	❑	❑	■	❑	❑	❑
File compression	❑	❑	❑	❑	❑	❑	❑
Drive compression	❑	❑	❑	❑	❑	❑	❑
Number of drives handled simultaneously	1	1	26	2	2	1	26
Data transfer capability	❑	❑	■	❑	❑	❑	❑
Serial connection	N/A	N/A	■	N/A	N/A	N/A	N/A
Parallel connection	N/A	N/A	❑	N/A	N/A	N/A	N/A
Drive mirroring	❑	❑	❑	❑	❑	❑	❑
Drive cache utility	❑	❑	❑	❑	❑	❑	■
Notepads	■	❑	■	❑	■	❑	❑
Outlining	❑	❑	❑	❑	❑	❑	❑

—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

tain *Commander* in RAM while you run other software, saving the need to reinsert program disks after exiting an application.

When you start the program with the standard installation, the right half of the screen contains a three-column file listing and the bottom lists current function-key assignments. F9 turns on the top-line menu from which you can select other operations. Some DOS commands listed in the Files pull-down menu include selections to copy, rename, and delete files. You can activate commands with single-letter keys, by mouse selection, or with function keys. Novices may find the interface confusing, but more-experienced users will appreciate the variety of activation methods as well as the inclusion of the DOS command line. The number of DOS commands in the *Commander* menus is average for a DOS shell.

SUITABILITY TO TASK

The Norton Commander

Simplification of DOS usage	●●●
File and directory management	●●●
Additions to a user's tool set	●●●
Customization/ automation of frequent operation	●○

Commander's flexibility is also seen in its disk and file management. You can configure the program to display one or two directory trees or file listings, independent or linked. You can use file tagging for copying, deleting, and moving files and you can search by file contents as well as name. Missing are the abilities to copy, delete, or move an entire directory with subdirectories.

You can execute a file in a *Commander* file listing with the Enter key or by mouse. You can also train *Commander* to launch applications and load specific files by associating the file extensions with the program necessary to run them. You set up the file extension list using *Commander*'s text editor, which is also used to create single-key custom user menus.

SHINING FEATURES

Commander shines at file viewing. You can see the contents of files from most major spreadsheet, word processing, and database programs, as well as .PCX graphics files, in their native formats. *Commander* automatically loads the correct application viewer if it's available; if not, it uses a text-view mode helpful for all except binary files.

One of *Commander*'s most outstanding features is *Commander Mail*, a *Lotus Express*-compatible program used to access

DOS Partner	SoftBreeze	XTree Pro Gold	PC-HookUP	The Norton Commander	PC Tools Deluxe	HyperPAD
ASCII, Lotus .WK1, *WordPerfect, XyWrite*	ASCII, hex, Lotus .WK1, *Microsoft Word, MultiMate, WordPerfect*	ASCII, *dBASE*, hex, Lotus .WK1, *Microsoft Word, MultiMate, WordPerfect*	ASCII, hex	ASCII, *dBASE*, hex, Lotus .WK1, *Microsoft Excel, Microsoft Word, Microsoft Works, MultiMate, Paradox, R:base, WordPerfect, XyWrite*	ASCII, *dBASE*, hex, Lotus .WK1, *Microsoft Excel, Microsoft Word, Microsoft Works, MultiMate, Paradox, R:base, WordPerfect, XyWrite*	N/A
None	None	None	None	.PCX	.PCX	GX2
○	●	○	○	○	●	●
N/A	○	N/A	N/A	N/A	●	○
N/A	○	N/A	N/A	N/A	●	●
○	○	○	○	○	●	●
○	○	○	○	○	●	●
○	○	○	○	○	●	●
○	○	○	●	●	●	●
N/A	N/A	N/A	●	●	●	●
N/A	N/A	N/A	●	●	●	●
N/A	N/A	N/A	○	●	●	○
N/A	N/A	N/A	●	○	●	○
N/A	N/A	N/A	○	○	●	●
N/A	N/A	N/A	○	●	●	○
○	●	○	○	○	●	●
○	○	●	● (only in data transfer)	○	●	○
○	○	○	○	○	●	○
1	26	26	26	2	2	1
○	○	○	●	●	●	○
N/A	N/A	N/A	●	●	●	N/A
N/A	N/A	N/A	●	○	○	N/A
○	○	○	○	○	●	○
○	○	○	○	○	●	○
○	○	○	○	○	●	●
○	○	○	○	○	●	○

ENDS

MCI Mail. You can't use this feature for any other type of telecommunications, but with *Commander Mail* you can set up automatic access times, log in to as many as seven MCI mailboxes, and even send binary files to other *Commander* or *Express* users. *Commander* makes it easy to set up distribution lists that include a mixture of recipient formats.

Commander Link is Peter Norton Computing's answer for data transfer between computers at the same location. The company sells a $29 cable, but any standard null-modem cable will allow you to transfer files between two computers via serial ports. Using *Link* you can copy, move, rename, and delete files on either connected computer, with one acting as the master and the other as a slave.

The *Norton Commander*'s manual is terrible. The occasionally flip style is acceptable, but it lacks such helpful structural components as a complete listing of program features or computer system requirements. The table of contents is program oriented, and the index is too limited. However, once you figure out where you need to be in the manual, the instructions for performing various operations are fine.

The Norton Commander is helpful for intermediate to expert users. The complete set of file viewers is admirable, and *Commander Mail* and *Commander Link* are particularly nice features that make the program suitable for portable PCs.

***The Norton Commander*, Version 3.0**
Peter Norton Computing Inc., 100 Wilshire Blvd., 9th Fl., Santa Monica, CA 90401; (213) 319-2000.
List Price: $149.
Requires: 256K RAM, DOS 2.0 or later. Hard disk recommended.
In Short: *Norton Commander* has powerful file-management features, including user-defined menus, file viewing in many program formats, and a launch-and-load function. Also included are Commander Mail for accessing MCI Mail and Commander Link for file transfer between computers. It is intended for all users and especially suitable for laptop users.

CIRCLE 609 ON READER SERVICE CARD

The Norton Commander, which can display files on either the right or left side of the screen, uses a combination of bottom-line and top-line menus with pull-down menus from the latter. In this screen, the Files pull-down menu lists several of *Commander*'s DOS functions. It's a good thing the menus are good, because the manual needs work.

PC Tools Deluxe

by Bruce Brown

EDITOR'S CHOICE

It's tough to compete with *PC Tools Deluxe*. With each new version, Central Point Software adds to the utility's collection of fine component programs and strengthens the previous set as well. The newest edition, *PC Tools Deluxe*, Version 6.0, is true to the tradition. This time, Central Point has even added user levels so that beginners and intermediate users don't have to face quite as many options as advanced users.

The first thing to know about the $149 *PC Tools Deluxe* (upgrades cost $30) is that it's big. The package comes on six 5.25-inch or three 3.5-inch floppy disks. After normal installation, the files take up almost 3MB of disk space, and you'll need some desk space as well for almost 1,000 pages of documentation.

SUITABILITY TO TASK
PC Tools Deluxe

Simplification of DOS usage	
File and directory management	
Additions to a user's tool set	
Customization/ automation of frequent operation	

The manuals aren't just for show. *PC Tools* is certainly a DOS shell, but it is many other types of software as well: disk and file manager, file and data retriever, telecommunications program, fax manager, disk cache program, security program, disk-compression and drive-mirroring program, disk- and tape-backup program, disk mechanic, and application menu program with automatic program recognition. To top it all off, *PC Tools Deluxe* incorporates a version of Traveling Software's *LapLink* file-transfer program to share files between laptop and desktop computers.

A peek at the features can help you grasp the comprehensiveness of *PC Tools Deluxe*. You'll be hard-pressed to find a DOS-command or a file-manipulation option that you can't access from within *PC Tools*. If you think you'll miss the DOS prompt, don't worry because a DOS command line is always on the screen when you're in the PC Shell program, just in case you want to do it on your own.

While you're in PC Shell you can run executable files, use any of 30 file viewers, and launch and load applications by pointing to data files and automatically starting the applications.

Even with all its features, *PC Tools Deluxe* remains fairly easy to use. The manuals run on a bit, breaking down every step into sometimes interminable detail; you'd be better off using the manual to install the program and then using the on-line help, menus, and prompts to learn the program. You can run the program from the keyboard but it's faster with a mouse.

VARIABLE USER LEVELS

Central Point Software has added variable user levels to Version 6.0. The number of

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PC Magazine said: "The excellent processor performance and expansion capability of the KEEN-3304 make it a very good network file server."

Key Features	KEEN-3300 Series	KEEN-2500 Series	KEEN-2035 Series	PEER-1630 Series
Processor	80386-33	80386-25	80386-20	80386SX-16
Configurations				
Tower Model	KEEN-3304	KEEN-2503	—	—
Desktop Model	KEEN-3302	KEEN-2500	—	PEER-1632
Mini-AT Model	—	—	KEEN-2032	PEER-1630
DRAM on Motherboard	Up to 8MB	Up to 8MB	Up to 4MB	Up to 5MB
32-bit DRAM (max.)	16MB	16MB	16MB	5MB
Cache Memory	64/256KB	64/256KB	—	—
Landmark Rating	59MHz	44MHz	26MHz	20MHz

25MHz. The KEEN-2500 Series has the same lightning fast cache memory scheme as the 33MHz and delivers 6.2 MIPS. It's Novell Certified for use with NetWare, and XXCAL Labs certified for compatibility with a long list of hardware, operating systems and, of course, the latest high-performance software.

Personal Workstation said: "The caching strategy and overall cache and board design undoubtedly affect system performance, boosting the DTK (KEEN-2500) to one of our top performers... one of the best high-performance bargains we've seen."

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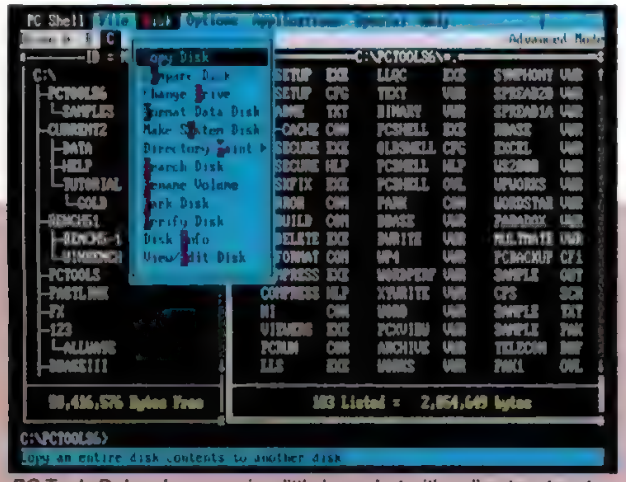
CIRCLE 102 ON READER SERVICE CARD

menu choices in PC Shell and Backup vary by the user configuration, with beginners getting the fewest choices and intermediate and advanced users getting more. The levels are a great idea and really a necessity in a program so feature rich.

In fact, *PC Tools Deluxe*'s only limitation as a DOS shell is that it does so much, some will prefer the simpler style of more-limited programs. The sheer number of menus, options, features, and functions can be overwhelming, even with the different user level configurations. While you can run the individual program components on a floppy disk drive system, most users will probably want to keep everything available all the time, which means you'd better be prepared to provide all that hard disk storage space.

PC Tools Deluxe 6.0 is a superior DOS shell program. It's also a terrific disk and file manager, an effective data-recovery tool collection, a superb desktop manager, an impressive computer security system, a powerful disk-backup program, and a speedy disk cache program. Any two of these features are worth the $149 list price. When you take them as a full set and throw in all the other functions and utilities, the collection becomes invaluable. No doubt Central Point Software is already making plans for Version 7.0, but let's appreciate the value of all that's here now.



PC Tools Deluxe's screen is a little busy, but with a directory tree to the left, file listings to the right, menus at the top, and stats, a DOS command line, and a user prompt at the bottom, everything you need is there. With the release of version 6.0, PC Tools Deluxe keeps getting closer to becoming a total operating environment.

***PC Tools Deluxe*, Version 6.0**
Central Point Software Inc., 15220 N.W. Greenbrier Pkwy., #200, Beaverton, OR 97006; (503) 690-8090.
List Price: $149.
Requires: 512K RAM, DOS 3.0 or later. Hard disk recommended.
In Short: *PC Tools* 6.0 does just about everything very well. Its newest features include three levels of user interface, a drive-repair utility, and an integrated version of Traveling Software's *LapLink*. You'll be hard-pressed to find a feature or function missing from this program.

CIRCLE 611 ON READER SERVICE CARD

THE DOS SHELL YOU'LL FIND IN DOS

by Abe Rosner

Are you tired of having to figure out how to use DOS commands? Frustrated by the disorganization of your hard disk? Microsoft wants to help. All releases of DOS, since Verison 4.0, have a built-in Shell option. Granted, this shell is not as sophisticated as any of the DOS shells evaluated here, but it is a marked improvement over the command prompt.

Microsoft has designed an SAA-compliant shell that can be operated with a mouse or function keys assigned to standard commands (F1—help; F3—exit; F10—bring up menu bar). When the Shell is invoked, user-configurable groups appear vertically on the left-hand side of the screen, while a menu bar appears horizontally at the top. Options for the file system and command prompt are also offered at startup.

With the increasing popularity of hard disks larger than 40MB, and DOS now supporting partitions larger than 32MB, Microsoft has sensibly included a graphical directory tree in its "DOS DOS shell." The file system supports point-and-shoot mouse operations that allow files to be printed, moved between directories, and copied with ease and without you ever having to touch the keyboard.

A group of files can be tagged and modified together—a task that DOS doesn't do from the command line—and you can also view two directories simultaneously. The Shell uses icons that are similar to the ones found in *Windows* and OS/2 to represent executable files.

MENU GROUPS

The Shell gives you groups of menus to choose from, a paradigm that is used widely in graphical environments. Within these menu groups, separate passwords can be assigned for different access levels. This is the first time that DOS itself has offered any kind of security.

Within the Shell, you can assign Associate files for certain file extensions. If you are *Lotus 1-2-3* user, for example, you may assign the file extension *.WK3 to 123.EXE, and by simply pointing the cursor to a .WK3 file, *Lotus 1-2-3* will be invoked. The shell allows for 20 such associations at one time.

The Shell provided with DOS 4.0 is a nice attempt at putting a user-friendly interface on the inscrutable operating system. If you can afford the extra 11K of memory used by the shell and the mouse driver, you'll find that the Microsoft DOS Shell is a pleasant environment in which to work. ■

Seagate's Technology

THE FINE ART OF DISC DRIVES

Neon Sculpture by
Lili Lakich
Los Angeles, California

To the naked eye, disc drives haven't changed much in the past few years. While the visible aspects have remained the same, the parts you can't see have improved dramatically. What used to be megabytes are now gigabytes. And Seagate is at the forefront of this technological revolution.

We've not only increased capacities, but we've found ways to make drives faster and more reliable. For example, Zone Bit Recording™ is a recording technique that permits higher capacity and faster average data transfer rates than conventional recording methods. Our straight-arm actuator has 60% less mass than most other designs, giving our Wren™ and Sabre™ families lightning-quick access performance. And by increasing spindle rotation 50% to 5400 RPM, we've significantly increased the transfer rate and reduced the latency in our 1.5 GB Elite™ drive.

As a result of these and other technological improvements, Seagate now offers drives from 20 MB to 2.5 GB in the widest range of form factors and interfaces imaginable, for almost every conceivable application. And we're not through yet.

Like the artist who spends years perfecting his craft, Seagate has spent the past decade mastering the fine art of disc drives. To get a first-hand look at the state-of-the-art, contact your authorized Seagate distributor, or call Seagate directly: 800-468-DISC, or 408-438-6550.

Seagate

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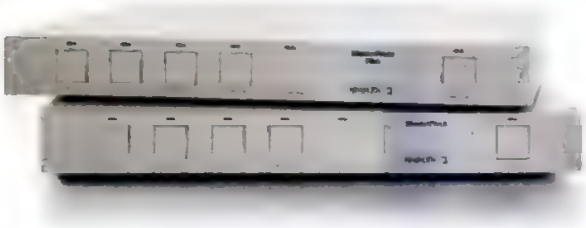

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PC-HookUP

by Bruce Brown

When you've gotta go, you've gotta go. If your going involves taking programs and files outside the office on portable computers, or if you just want a quick way to send data between desktop PCs, take a good look at the feature set in Brown Bag Software's *PC-HookUP*.

PC-HookUP lists for $129.95, which includes a heavy-duty data-transfer cable with three plugs on each end—a 9-pin and 25-pin serial and a 25-pin Centronics parallel. Your money buys more than just data-transfer software, however, because *PC-HookUP* includes a regular telecommunications program, a text editor, help with DOS commands and file management, and a limited file viewer.

The program files take up about 170K of disk drive space, and *PC-HookUP*

SUITABILITY TO TASK

PC-HookUP

Simplification of DOS usage	
File and directory management	
Additions to a user's tool set	
Customization/ automation of frequent operation	

needs just 128K to 300K of RAM, depending on how many directories and files it has to manage. For least memory usage you can run *PC-HookUP* in a "small" mode that logs only 127 directories and 252 files; using this, you can get by with less than 512K of system RAM. *PC-HookUP* works with all versions of DOS 2.0 or higher and runs just fine on Novell network workstations, although it's not a network product.

PC-HookUP's DOS-shell functions work via pull-down menus and pop-up windows selected from a top-line menu. You can pull up a DOS command line to execute multiple commands, or use a single-command window. HookUP-DOS, a set of specific DOS-like commands, lets you copy, move, or delete files and issue subdirectory commands; two of the most powerful are Prune and Hacksaw. Prune erases all files from a directory and any subdirectories, but leaves the directory structure. Hacksaw deletes both files and structure. Both are convenient, but exercise caution until you know exactly what you're doing.

You can use the Commands menu to display a directory tree and move around the structure. You can also search for files by name, wildcard, or contents, and sort by name, extension, date, size, and attribute. You can execute .COM,.EXE, and .BAT files from *PC-HookUP* as long as enough memory is available for DOS, *PC-HookUP*, and the executed program simultaneously. There is no menu creation feature in this program, but Brown Bag would be happy to sell you *PowerMenu*, its menu- and file-management system combination (reviewed separately).

PC-HookUP's text editor is fine for small jobs, but if you'd rather use your own word processor you can configure it to start your program instead of its own. File viewing is limited to ASCII and hex file format.

Of course, the premier *PC-HookUP* function is file transfer with speeds of up to 115,200 bits per second via serial ports, and approaching 500 kilobits per second with parallel connections. It's simple to select single files, tagged files, or whole directories for transfer. When you're hooked up to another computer you can enter a chat mode that divides both screens in half horizontally and activates each keyboard so that users can communicate with each other even if the computers are not in the same room. Using a serial port, users as far as 1,000 feet away can be connected.

PC-HookUP's telecommunications module allows up to 2,400-bps transfer via COM1, COM2, COM3, and COM4—even up to COM7 if you can get DOS to recognize such a port. There is no scripting language or auto-logon facility, but you can set up a telephone directory for auto-dialing; there's also an ANSI-terminal emulation mode. For product information you can dial into Brown Bag's BBS, which has regional access telephone numbers in several parts of the country.

> The premier *PC-HookUP* function is file transfer, with speeds of up to 115,200 bits per second via the serial ports.

Unlike most of Brown Bag's software, *PC-HookUP* is not available as shareware, although you can download a demo version of the package from the company's BBS. If you read the program manual (not really necessary for many functions since the program is so simple to use), you'll run into testimonials for some of the vendor's

PC HookUP's main screen displays local drive files on the right, file statistics and a function-key prompt on the left, and a top-line menu. When you activate a top-line menu item, a convenient pull-down menu presents you with options for that menu, as shown above with the *HookUP*-DOS menu.

other software that are mixed in with operating information.

PC-HookUP's combination of features is especially suited for portable-computer users who want a DOS shell and file manager, as well as the ability to communicate or transfer files while on the road. The many utilties in this program certainly warrant your getting one to "go."

***PC-HookUP*, Version 2.0**
Brown Bag Software Inc., 2155 S. Bascom Ave., #114, Campbell, CA 95008; (800) 523-0764, (800) 323-5335 (inside Calif.), (408) 559-4545.
List Price: $129.95.
Requires: 512K RAM, DOS 2.0 or later.
In Short: *PC-HookUP* is a file-transfer program that has file-management facilities and menus for most common DOS commands. Other features include a flexible telecommunications program, a remote chat mode, and a text editor. This combination of programs makes it a natural for laptop users.

CIRCLE 610 ON READER SERVICE CARD

PowerMenu

by Bruce Brown

Not sure which DOS shell to use? It wouldn't hurt to try *PowerMenu* for free. If you like it, just send in a check for $89.95 to become a registered user; you'll get the manual and the right to free vendor support. Not that you would go wrong if you bought the product in the first place—it certainly has the value to back up a purchase decision.

PowerMenu's feature set includes a menu maker, DOS command support, and a Directory tree-based file and disk manager. Other features are system information and status, a screen saver, and a security and usage auditing system that could sell as a standalone product.

During normal operation *PowerMenu* uses 20K to 120K of RAM, but when running applications it drops back to just 2.4K. A hard disk drive isn't required, but it certainly makes sense in order to get the most from this program.

Fundamentally menu software, *PowerMenu* gets started at the point where many others of its class stop. It searches your drive and automatically creates menu items for most popular applications. You can also manually add, edit, or delete menu selections. You can store paths, start-up commands and program parameters via menu-item editing, which results in faster program startup than if you typed the commands in yourself.

The security and activity logging system can be used to control user access to individual menu items and to restrict DOS access; it can even stop users from leaving *PowerMenu* or changing program colors. Of course, you'll want a supervisor to es-

LOTUS MAGELLAN: The Ultimate DOS Shell?

by Bill Howard

If you want one program that provides a shell for DOS commands, helps you navigate your disk, and launches your applications, consider *Lotus Magellan*. While this $199 marvel is best known for its elegant indexer, which lets you find any phrase on a typical disk in less than five seconds—branding *Magellan* as a text search and retrieval program—it's also part DOS shell and part menuing system.

Magellan assumes that once you've located a word or phrase, you'll want to do something with the files containing those phrases. As with most DOS shells, you can group, copy, move, delete, sort, back up, or print files. There's a visual tree, of course, and *Magellan* lets you run (or launch) your favorite software applications from a menu.

Magellan's Viewers further distinguish *Magellan* from your garden-variety DOS shell. *Magellan* lets you view data in its native format as you browse through file lists. Your spreadsheet files appear as though *Lotus 1-2-3* were loaded and your word processor files appear as if you were running *WordPerfect* or *WordStar*. This feature helps confirm that you are actually copying or deleting the right file, something most other DOS shells currently on the market just don't allow.

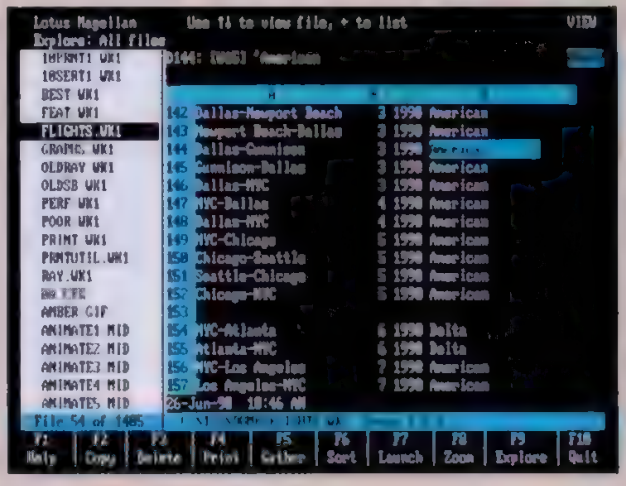
And if you want to run the program associated with the data file you're viewing, simply tap the F7 key for *Magellan* to hide itself away, and then load your application. *PC Tools Deluxe*, *The Norton Commander* and others now include viewers, but *Magellan* remains far ahead in both quantity and quality.

While it's true that *Lotus Magellan* doesn't include every feature of every other DOS shell and menuing system, it's robust in so many areas that *Magellan* may be all you ever need. ■

FACT FILE

***Magellan*, Version 2.0**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $199.
Requires: 512K RAM, hard disk, DOS 2.0 or later.

CIRCLE 619 ON READER SERVICE CARD



Magellan Viewers let you see a data file as if you were running the underlying program. At left, a .WK1 file displayed in the *Lotus 1-2-3* format. *Magellan* also includes the core capabilities of DOS shells and menuing systems.

Your wish is our Commander.

In your wildest dreams, if you could do absolutely anything you wanted with your data files, what would you do?

You'd want to organize them, of course. Manage them, too.

From time to time you'd probably need to look for them.

But most of the time, you'd just want to look *at* them—or through them—instantly.

Occasionally you might even want to send them to someone else so they could look at them, too.

Or transfer them to your laptop so you could play with them at home. Or away from home.

Naturally, you'd want to be able to do all of these things without having to do much of anything yourself.

Maybe pull down a menu, hit a couple of keys or nudge your mouse every so often.

Near-Perfect DOS shell Emerges as Market's Best

InfoWorld *thinks the world of the Norton Commander. And so will you.*

Seeing is relieving.

Well stop dreaming. Because the Norton Commander® is here. And it's better than anything else you can use to deal deftly with DOS.

How much better, you ask?

Well, *InfoWorld* called the original version "tops in its class…a new level of convenience for MS/DOS users."

They called Version 2.0 "a near-perfect DOS shell…the market's best…recommended for all DOS users, regardless of expertise."

Version 3.0 is better still.

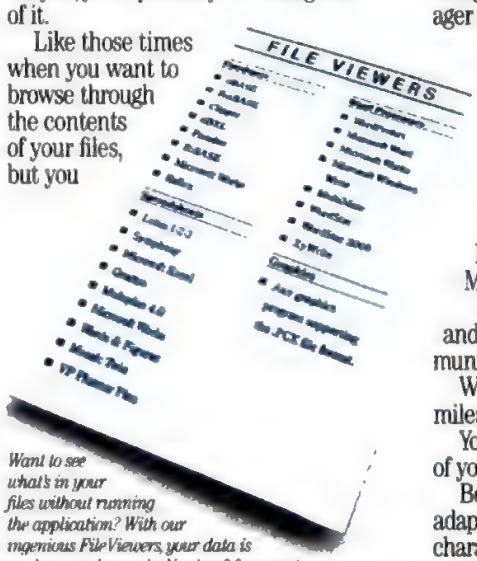
Now you see it.
Now you don't have to.

Our latest version combines all the functions of a hard disk manager with all the features you need to support and enhance the DOS command line.

Yet it's flexible enough to adjust totally to your particular style of working—even get out of your way entirely when you don't need to see it.

But since it can do so many things for you, you'll probably be seeing a lot of it.

Like those times when you want to browse through the contents of your files, but you haven't the time—or the patience—to load and run the applications that created the files in the first place.



Want to see what's in your files without running the application? With our ingenious File Viewers, your data is as close as a keystroke. Version 3.0 supports most leading business applications.

Thanks to our ingenious File Viewers, all you have to do now is point to the filename and shoot.

Presto, you're eyeballing your data.

Fire again and you've launched the application.

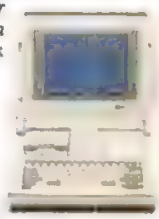
In fact, a couple of keystrokes—or mousestrokes, if you prefer—is all it takes to perform the full range of file management functions.

Or, for that matter, to call up a tree view of your directories, a list of your last 15 commands, or a menu of your favorite programs and routines.

What could be easier? Faster? More efficient?

Certainly nothing we've heard of.

The new Norton Commander speaks laptop, too. It adapts to your LCD display automatically. And our new Commander Link makes it easy to transfer files between two systems.



Armed with the fax.

Speaking of things you haven't heard of before, imagine using a DOS manager to send faxes to any of the world's 4,000,000 or so fax machines.

Dream on, right?

Wrong. Commander Mail™ not only lets you do that, it lets you instantly exchange files, telexes and E-Mail with any MCI Mail® subscriber—in Milwaukee, in Mongolia, even in Marketing.

Without having to laboriously load and run one of those tiresome communications programs.

Who knows, you may get some mileage out of your modem for a change.

You'll definitely get more mileage out of your laptop PC.

Because the Norton Commander adapts to your laptop's LCD display characteristics.

And our Commander Link™ lets you transfer files from desktop to laptop—and back—quickly and easily.*

So before you go back to dealing with DOS the hard way, see your favorite software dealer.

If you haven't got a favorite software dealer, call us right away at **1-800-365-1010.**

And order us around.

Peter Norton
COMPUTING

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*Requires a serial cable. Coupon offer for cable is included with package.

CIRCLE 302 ON READER SERVICE CARD

tablish all other user accounts, passwords, and access rights. You can save a record of all program activity in an encrypted file that only the supervisor can access. As it stands, *PowerMenu* isn't a network program and is licensed for just one PC; you'll need *PowerMenu* 5.5 for LANs, which costs $750 for ten users. But even if you'll be the only person using *PowerMenu*, the logging system can track time spent on various projects and record hourly rates for documenting project costs or client fees.

PowerMenu, which is available as shareware, uses pop-up menus extensively, like the above Utilities for the Computer menu from which some of this program's DOS operations are selected.

PowerMenu includes a decent but not overly impressive selection of DOS and file-management commands. If you need to issue an unsupported command you can always run a DOS command line from within the program (assuming you have access rights assigned to your user account). There's no text editor included with *PowerMenu*, but you can set it up to load any editor or word processor you please.

Unfortunately, the manual doesn't match the quality of the program. There are some confusing references and the explanations for a few of the program's features, such as setting up project codes and costs, are left out. There's so much power in this program it's too bad the manual isn't as good.

If you're determined to try the program before buying it, as long as you have a modem and communications software, just dial into Brown Bag Software's Bulletin Board Service—in New York, (212) 313-1260 and in California, (408) 371-7654—to download the program. The system is also available as shareware via CompuServe, as well as many user and special interest groups (SIGs).

PowerMenu is a terrific program. It's not appropriate for beginners without help from someone more experienced to set it up, but more-advanced users who work with many different programs will appreciate the convenience of its stored settings that speed movement between applications. The easy access to system and file status information is another feature that will endear this program to power users. In all, *PowerMenu* is worthy of recommendation.

SUITABILITY TO TASK

PowerMenu

Simplification of DOS usage	
File and directory management	
Additions to a user's tool set	
Customization/ automation of frequent operation	

***PowerMenu*, Version 5.0**
Brown Bag Software Inc., 2155 S. Bascom Ave., #114, Campbell, CA 95008; (800) 523-0764, (800) 323-5335 (inside Calif.), (408) 559-4545.
List Price: $89.95.
Requires: 256K RAM, DOS 2.0 or later. Hard disk recommended.
In Short: *PowerMenu* 5.0 is intended for both beginners and advanced users. It has both user- and program-password systems and can even track projects and hourly usage costs. This program is aptly named, and since it's available as shareware you can try it for free.

CIRCLE 612 ON READER SERVICE CARD

Power Panel

by Bruce Brown

EDITOR'S CHOICE

Heads will turn after you install Mouse Systems' *Power Panel* DOS shell and menu program. The opening screen is beautiful in color, and the $69.95 product is robust, loaded with DOS and file utilities and desktop tools. As you might expect from the vendor's name, *Power Panel* supports Microsoft, Mouse Systems, and other compatible mice.

Power Panel's primary function is to automatically set up menus for approximately 600 applications. If it finds multiple applications in a category, it sets up a submenu for the category. You can also manually add, delete, or edit menu items. If you set up *Power Panel* to start automatically, you could go for weeks or months without ever exiting to DOS. With optional password settings for menu maintenance, disk operations, DOS access, communications, and even date and time settings, you can set up computers for novice users and be reasonably sure that they won't be able to perform any functions for which they don't have valid passwords.

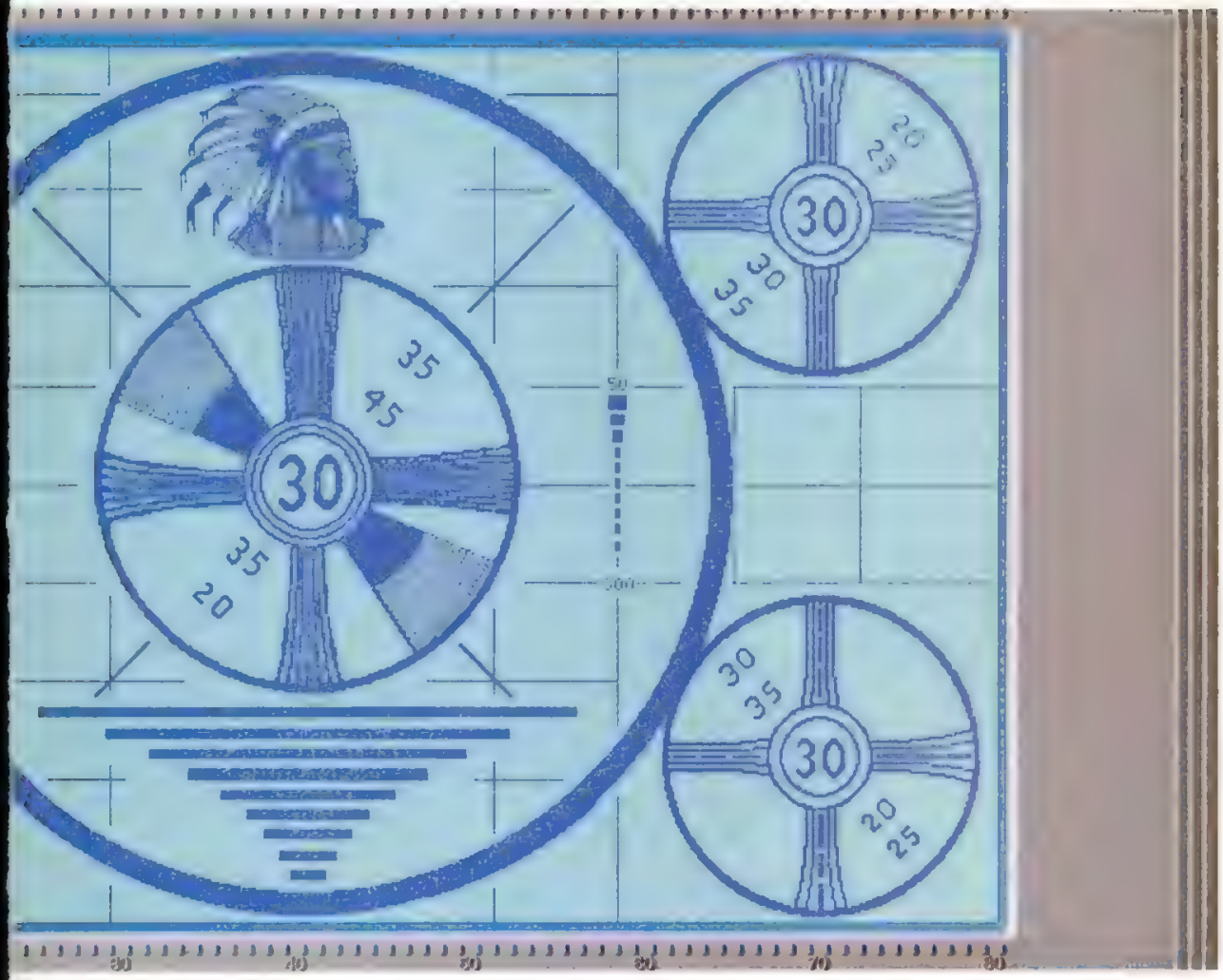
SUITABILITY TO TASK

Power Panel

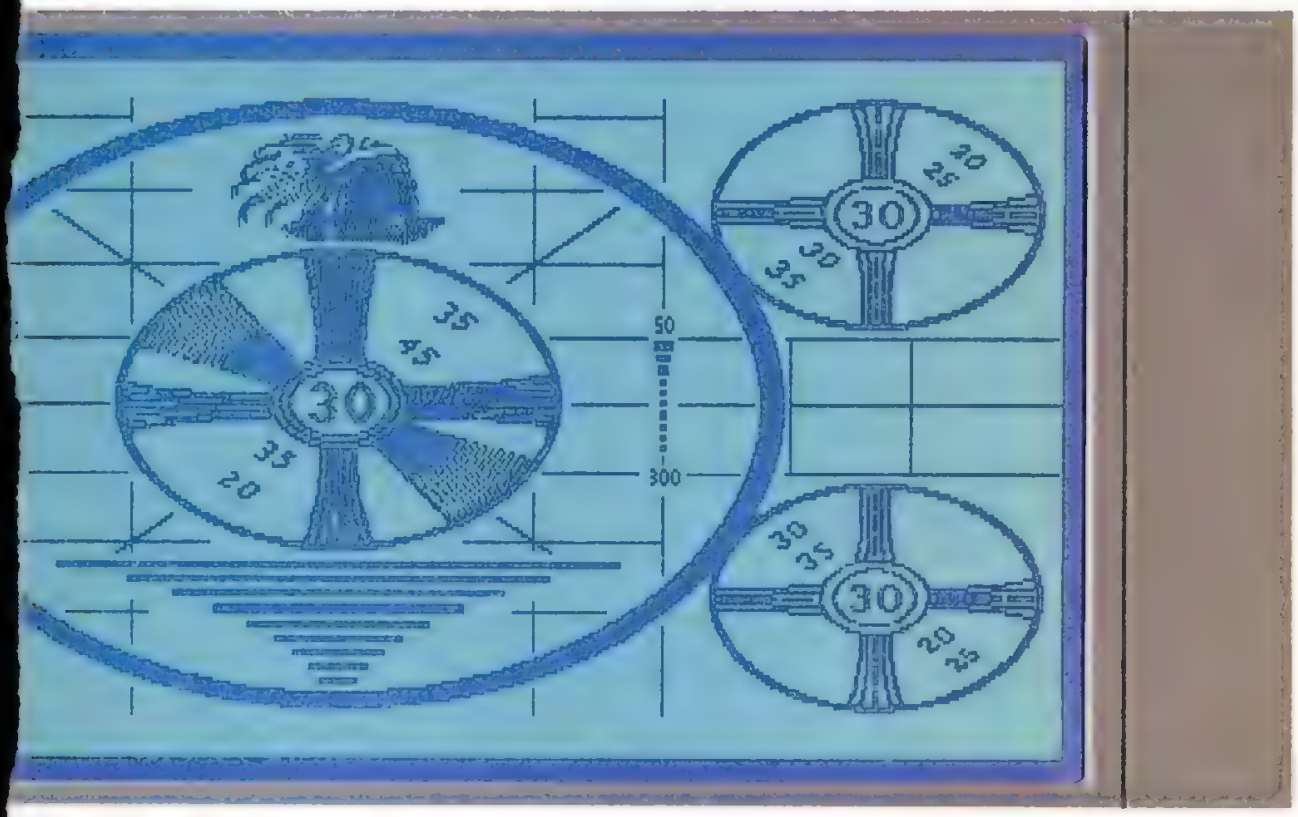
Simplification of DOS usage	
File and directory management	
Additions to a user's tool set	
Customization/ automation of frequent operation	

Power Panel's list of DOS functions is one of the most complete programs that we evaluated, and its file and disk management services are extensive as well. However, file viewing in native formats is light

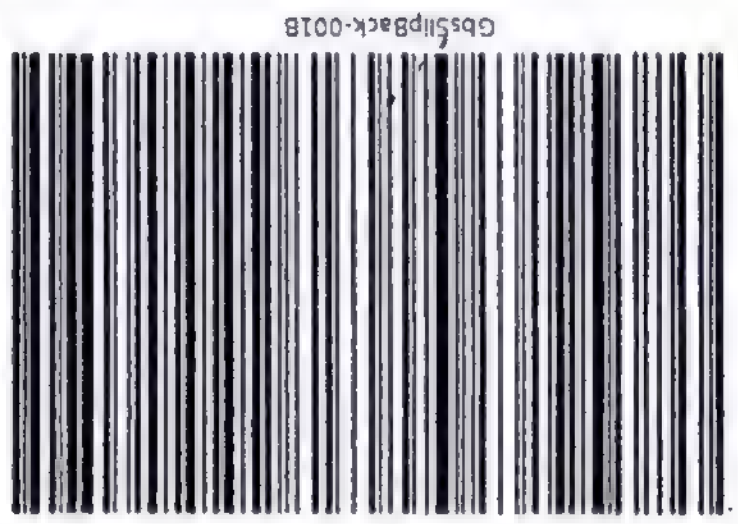
If you're not sure which notebook PC to buy, take this simple test.



TOSHIBA T1200XE SCREEN



COMPAQ LTE/286 SCREEN



Back

1. Follow instructions on the other side

Inverted Back

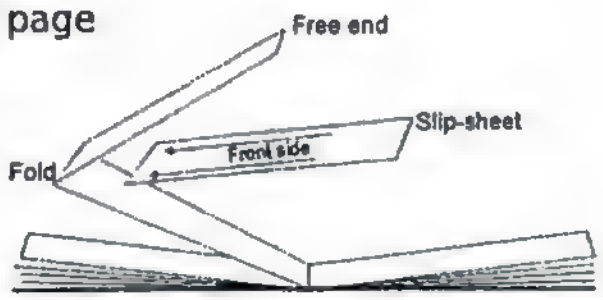
1. Follow instructions on the other side

Folded edge of the page

GbssilpSheet-001

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Take a peek at the two screens shown and you'll probably notice a big difference.

As you can see, the Toshiba T1200XE's screen isn't only 22% larger, but it's also much brighter. Clearer. And easier to read.

The reason is simple. The Toshiba boasts a 640x400 double scan pixel LCD. Spell that out and you get twice as many pixels as Compaq's, and a screen which is supported by most major software packages.

Our screen is also sidelit. An impressive detail that not only makes our screen brighter than Compaq's backlit screen, but makes it last longer, as well.

All of which means that the Toshiba T1200XE's screen is easier on the eye.

Maybe that's why our screen reads more like a screen. And theirs reads more like, well, a display.

Now, take a look at the circles on the screen. Toshiba's circles are circles, not ellipses. In other words, with the Toshiba a pie chart is a pie chart. Not an egg chart. The world is round. Not flat. Anyway, you get the picture.

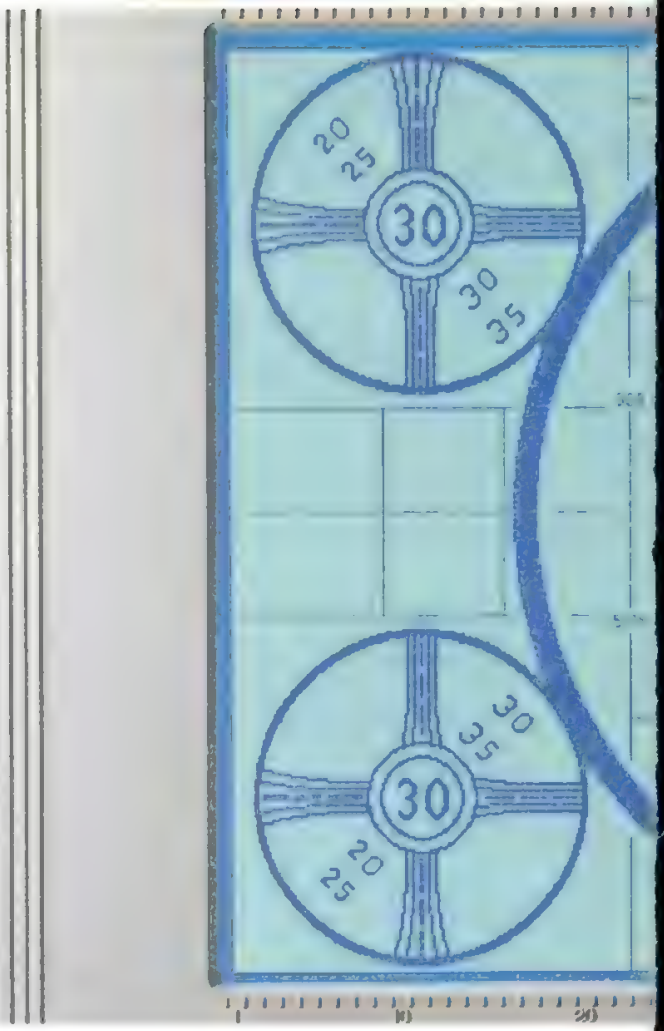
The Toshiba isn't only brighter and more well-rounded, but it's smarter too. That's because, unlike the Compaq, every Toshiba has AutoResume built-in.

So if you have to switch off because you're about to switch planes in Athens, Greece or Athens, Georgia, AutoResume works like an electronic bookmark. No rebooting. No reloading. No retrieving. No kidding.

Simply turn it on and the Toshiba takes you right back to where you were faster than you can read this sentence.

So you'll be pleased to discover that our engineers worked exceptionally hard with the Toshiba T1200XE. That way you don't have to.

See. We just made your job a lot easier.



First, pass this
screen test.

Next, take this
manual dexterity test.

The Toshiba T1200XE is also pretty handy in the keyboard department. For example, try this for size.

First, type your name, your boss' name, or a name for your boss on the Toshiba keyboard pictured on the left.

Now, try and edit your name, your boss' name or whatever, using the cursor and function keys. Hopefully, you'll feel a comfortable, logical familiarity with the keyboard spacing and layout. Just like your everyday desktop PC.

Compaq, on the other hand, had to do a bit of compromising. A number of keys (twenty-seven, to be exact) are smaller in width so they might feel cramped. That means it's uncomfortable.

In fact, some keys are hard to find, giving new meaning to the term "hunt and peck." Can you spell frustrated?

By now, you've also probably noticed something quite different in the lower right hand corner. At least on the Compaq keyboard. The cursor keys are in a different layout than your standard inverted "T," which can lead to unnecessary mistakes. Like this one.

Now try and find the PgUp key on the Compaq. Once you finally find the PgUp key, you're not going anywhere. Yet. There's more.

You still have to find the Fn key in the lower left hand corner to initiate the PgUp key. Or the PgDn key. And the Home key. And the End key. Which is something you unfortunately would have to get used to.

Just think. It's almost like going to a foreign country and having to drive on the other side of the road. See what happens when you compromise and make your keyboard too small?

Now, try the same functions with the Toshiba. Notice the keys? They're logically arranged. So, not surprisingly, the Toshiba isn't only a cinch to use, but makes editing a piece of cake.

Here's another Compaq compromise; the keyboard isn't only smaller, it's flat.

While Toshiba's keyboard is completely sculpted with full-stroke keys for better feel and travel. Pretty neat, huh?

Our point is simply this; in some cases, size is everything.

times.

TOSHIBA T1200XE KEYBOARD

COMPAQ LTE/286 KEYBOARD

Actual size and unretouched photographs, using identical exposures

Congratulations, you've probably come to the same conclusion that 8 out of 10 business professionals have.

	TOSHIBA T1200XE	COMPAQ LTE
Processor Clock Speed/Switchable Math Co-Processor Socket	80C286 12/6 MHz No	80C286 12/8 MHz Yes
Min RAM (Standard) Max RAM Hard Drive Hard Drive Access Floppy Drive Floppy Capacity	1MB 5MB 20MB 25ms (1) 3.5" 1.44MB	640KB 2.6MB 20MB, 40MB 29ms, 29ms (1) 3.5" 1.44MB
Display type Screen Size Gray Scales Resolution Video Type	Side lit LCD 4.96" x 7.92" 2 640 x 400 CGA	EL Backlit LCD 4" x 8" 4 640 x 200 CGA
Weight Height Width Depth	7.9 lbs.* 2" 12.2" 11"	6.7 lbs. 1.9" 11" 8.5"
# of Slots Type of Slots Keyboard Handle Ports	1 Dedicated modem 82 keys Yes (1) Serial, (1) Parallel Ext. Keypad, Ext. Bus Conn. RGB	1 Dedicated modem 80 keys No (1) Serial, (1) Parallel Ext. Keypad, Ext. Floppy RGB
Power (Battery Life) Recharge Time—Power Off Recharge Time—Power On	Removable battery (1.5hrs)/AC 3 hrs. 8 hrs.	Removable Battery (3.5hrs)/AC 8 hrs. 10 hrs.
Bundled Software	MS DOS 4.01, PC-Kwik Util Hypertext Doc.	Password, Disk Cache S/W MS DOS 3.3 ($120 extra) MS DOS 4.01 ($150 extra) PWRCON (Power Utility)
Options:* Modem (BPS) Carrying Case Other Options	2400 Yes 2MB memory Card Battery Packs, Quick Charger Ext. Keypad, Auto Adapter Ext. 5¼" FDD, Docking Stat. MS DOS 3.3	2400 Yes 1-2MB Memory Card Battery Packs, Quick Charger Ext. Keypad, Auto Adapter Ext. tape drive, Ext. FDD 5¼", 3½" OS/2 1.1
Retail Price	20MB—$3,999	20MB—$4,499

*Note with longer-life battery, total weight is 8.1 lbs.

If you didn't know which notebook PC to purchase before you took this test, we hope you do now.

If you're still not too sure, maybe this might help; during a recent test conducted by an independent research company (the test was appropriately named the "Toshiba Challenge" using the T1200XE and Compaq LTE/286), eight out of ten business professionals preferred Toshiba's bigger screen over Compaq's.

Eight out of ten business professionals preferred Toshiba's bigger keyboard layout over Compaq's.

And after viewing this feature chart, eight out of ten business professionals preferred the Toshiba over Compaq.

There is one thing Compaq's LTE/286 has that is bigger than the Toshiba T1200XE.

But that's something you'll figure out when you see the price tag.

See your nearest Toshiba dealer today and take the challenge for yourself, or call 1-800-457-7777. The call's on us.

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in comparison to other program functions, with support for ASCII and hex files only.

ALL THE EXTRAS

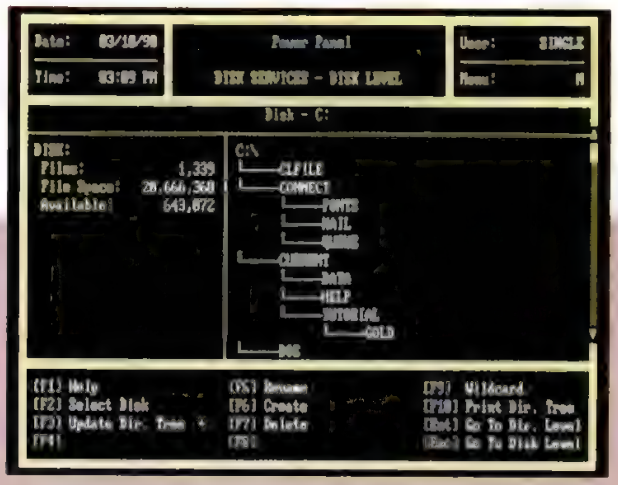
Power Panel's list of extra tools is extensive. In addition to a desktop set including a calculator, calendar, and notepad, there's a communications program with telephone directories, auto-dialing and auto-logons, terminal emulation, and a telecommunications script language. You can also use the communications module with a null-modem cable for direct-connection file transfer between computers at speeds up to 115,200 bps via the serial port. Other features include file encryption, macros with macro editing, and a screen saver with variable time-out settings.

For all its features, *Power Panel*'s own system demands are, surprisingly, fairly modest. Under normal installation it needs approximately 700K of disk storage space. When you use the program, it needs at least 300K RAM but it drops back to just 94 bytes when you begin running other applications. Theoretically, you can use *Power Panel* on floppy disk drive systems, but the limited space available for applications would make its menus overkill.

Power Panel has broad appeal. Advanced users who don't like menus might chafe a bit, but once you get used to the structure you can move rapidly among its features and functions. Beginning users set up with *Power Panel* by PC managers, VARs, or dealers should find themselves productive much quicker than those who face cold, hard DOS on their own. Intermediate-level users can also benefit from *Power Panel*'s relatively complete function set and utilities, and the ease with which they can get more from DOS. Overall, it's a very good program, with its gorgeous opening screen being the least of its many qualities.

***Power Panel*, Version 1.0**
Mouse Systems Corp., 47505 Seabridge Dr., Fremont, CA 94538; (415) 656-1117.
List Price: $69.95.
Requires: 384K RAM, hard disk, DOS 2.1 or later.
In Short: *Power Panel* is a versatile program for beginners and experienced users who want to save time. It is primarily an applications menu system that also helps with DOS and file management. Desktop accessories and a telecommunications module increase this intelligently integrated program.

CIRCLE 613 ON READER SERVICE CARD



Power Panel divides the screen into multiple sections or panels. The display above shows *Power Panel*'s Disk Services Panel with a Disk-level view (as opposed to a Directory level) with panel-specific function-key assignments on the bottom of the screen.

Q-DOS II

by Bruce Brown

Simplicity can be a virtue, and apparently it sells pretty well, too. Gazelle Systems has targeted the beginning user with its straightforward $79.95 *Q-DOS II* DOS shell and file-management program. You'll find few fancy features and no power tools either—just a reasonably easy-to-use tree-based directory viewer with a single-level top-line menu of DOS commands and file functions.

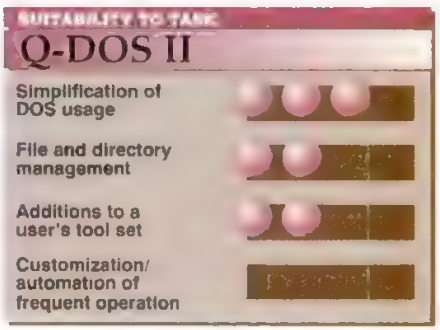
Q-DOS II doesn't require a hard disk, but as is the case with all DOS shells, you'll get more from the program if you use it with multiple files and directories. When you install *Q-DOS II* it takes 245K of disk space, and it requires a constant 128K of RAM to run.

DOS commands in *Q-DOS II*'s repertoire include ATTRIBUTE, COPY, DEL, DIR, CD, MD, RD, TREE, MOVE, PRINT, RENAME, and XCOPY. If you want to issue a different DOS command, tap the F6 key to activate the always present command line. Another function key, F2, displays date, time, current drive and file, file-sort sequence, drives available, keyboard lock-key status, installed system RAM, and the amount of free RAM.

You can select the Directory function from the top-line menu to display a tree and to create, delete, or move around it. There are several file-tagging options for multiple file operations including an Invert feature that changes untagged files to tagged status and vice versa. File-sorting options within directories include the standard ascending and descending sorts in order by filename, file extension, size, and date. Sorts aren't permanent and you can always unsort to view things in their original order.

Q-DOS II is extremely fast. We didn't set up any performance tests for this set of reviews, but when you move between *Q-DOS II* functions, sort or search files, or run applications, *Q-DOS II* seems to snap right back with the desired action quicker than its competition.

In keeping with *Q-DOS II*'s aim to make life easier for beginning DOS users, the 126-page manual is helpful without being overly technical. You may never need to refer to it, but if you do you'll find a no-nonsense tone that clearly explains what



should happen with each function, and it often relates common problems or reasons for failure of specific functions.

CLUTTERED SCREEN

Accepting *Q-DOS II*'s mission to remain a simple program, there is only one criticism: its main screen. The display is crowded with file listings, a menu bar with prompts, the DOS command line, directory statistics, a function-key template, and copyright information. The strategy is to prevent users from getting lost when paging through multiple displays; that's certainly fair, but this screen is too cluttered.

Gazelle's representatives describe *Q-DOS II* as "lean, mean, and simple" and they're right. Power users will stay away from this program because it doesn't add new functions to DOS and its speed of operation isn't enough to recommend it. Gazelle Systems won't miss the power users, however; there are plenty of others out there who are afraid to use their PCs and will be happy to receive the help that *Q-DOS II* offers.

***Q-DOS II*, Version 2.0**

Gazelle Systems, 42 North University Ave., #10, Provo, UT 84601; (800) 233-0383, (801) 377-1288.

List Price: $79.95.

Requires: 256K RAM, DOS 2.0 or later. Hard disk highly recommended.

In Short: *Q-DOS II* brings simplicity and clarity to DOS command execution and disk and file management. Just right for beginners.

CIRCLE 614 ON READER SERVICE CARD

Q-DOS II's attractive screen shows files on the right, a top-line command menu, and directory statistics and function-key assignments on the left. PC novices will appreciate its simplicity.

SOFTWARE

DOS SHELLS

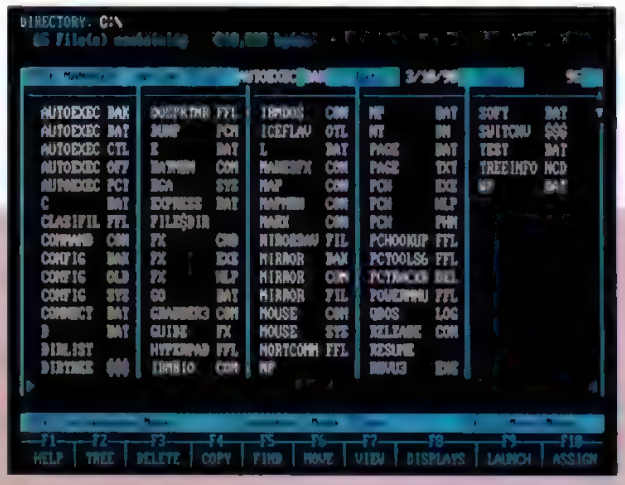
SoftBreeze

by Bruce Brown

When SoftShell Systems designed its *SoftBreeze* DOS shell and file- and disk-management program, it made up a mythical, target user and tried to figure out what he needed. It even gave this user a name, Don Greenwood. The result is a program that hits the middle ground; *SoftBreeze* isn't a power user's tool and it's not for rank beginners either.

SoftBreeze was developed with SoftShell Systems' Nautilus user-interface development language, which isn't included within *SoftBreeze*'s $99 list price. After installation, *SoftBreeze* takes up about 900K of drive space and uses a fairly constant 31K RAM. Microsoft, Logitech, and compatible mice are supported, but you can run *SoftBreeze* quickly from the keyboard as well.

According to the vendor, the mythical Don Greenwood has an 8088-, 8086-, or 80286-based standalone computer with 512K to 2MB RAM and a 20MB to 70MB hard disk. He uses several applications



SoftBreeze's File Manager displays five columns of files and lists a DOS-command function-key menu on the bottom of the screen. You can view and launch files from this screen, and with the Tree command (F2) you can also bring up a quick directory tree.

reasonably well and knows how to use DOS. His key operational issue is a need to move quickly between applications and files. He's tired of sitting in front of the DOS prompt, largely because he knows he could get more from his system, but he isn't trained or motivated to create his own programs. Don isn't a power user, but he looks forward to a little challenge, especially if it will pay back with added functionality.

Given Don's needs, *SoftBreeze*'s designers built in a selection of tools to help him become more productive without needing to become a programmer. The range of features include application switching, application menus, launch-and-load capabilities, memory mapping, and a screen saver. Other helpful utilities are a limited DOS command history, applications password protection, programmable function keys, a text editor, and file

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Previous Address: Dates of Residence: From To

Your Employer: (If self-employed, see rear panel) Date of Employment: Mo. Yr. Position: Monthly Income: Gross $ Net $

Employer's Address: Street City State Business Phone: ( ) –

Previous Employer: Address: Dates of Employment: From To

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation. Other Income: I have received since: (Date) Monthly Income: Gross $ Net $

Name and Address of Nearest Relative Not Living With You: Relationship

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Bank Account: ☐ Checking ☐ Savings

	Payment	Balance
Bank Loan References:		
Bank Card References: ☐ VISA ☐ MasterCard		
Other Credit Card References		
Other Credit References: Account No: Expires:		

Driver's License No. State: Expires:

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Address Street Apt. # City State Zip Date of Residence: Mo. Yr Home Phone ( ) –

Employer: Date of Employment: Mo. Yr. Position: Monthly Income: Gross $ Net $

Employer's Address: Street City State Business Phone: ( ) –

d. Self-Employed Information

Complete this section only if you are self-employed.

Business Name ☐ Proprietorship ☐ Corporation ☐ Partnership

Business Address: Business Telephone: ( ) –

Description of Business: Your Position: In Business Since

Your annual income from business: Business' annual income: (gross) (net)

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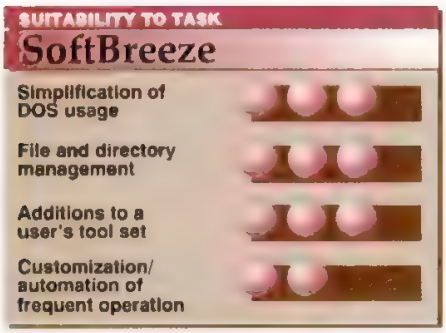
viewers for major word processor files and *Lotus 1-2-3*. You can also access the DOS command line from within *SoftBreeze*. The function list continues with file sorting and simultaneous logging of up to 26 drives.

Rather than having one major application niche, *SoftBreeze*'s implementation reflects its toolbox-design approach. The interface is based on top-line menu selections that activate pull-down menus with pop-up option screens. *SoftBreeze* uses several types of screens for its various tools. The downside is that you can get confused about a function's location and what its screen looks like. On the other hand, a cohesive screen that kept everything tightly tied together could also require too much movement between program modules and defeat Don's need to streamline operations.

Most of the major DOS file and disk manipulation and management functions can be implemented from *SoftBreeze*'s menus. Don can still create custom menus and automate function keys so there's room for additional creativity, but even without further customization, *SoftBreeze* succeeds in providing intermediate users with a helpful set of DOS tools and enhancements.



For beginners, *SoftBreeze*'s variety of screens can be an impediment, and if you're already an expert, you probably have other tools that can perform most of *SoftBreeze*'s functions or you could write your own with little trouble. If your profile is similar to Don's, however, you might take a look at this helpful set of tools. SoftShell Systems has a 30-day money-back guarantee if you try *SoftBreeze* and find that it isn't right for you. In the meantime, if you don't need the features of *SoftBreeze*, be sure to tell Don about it.

SoftBreeze, Version 3.0
SoftShell Systems, 1163 Triton Dr., Foster City, CA 94404; (800) 322-SOFT, (415) 571-9000.

SOFTWARE
DOS SHELLS

List Price: $99.
Requires: 512K RAM, hard disk, DOS 3.0 or later.
In Short: *SoftBreeze* 3.0 combines program menus, task switching, disk and file management, and computer memory management. It's intended for intermediate users who work with several applications and can use DOS, but want a program to help speed up operations.
CIRCLE 615 ON READER SERVICE CARD

Tree86 Plus

by Bruce Brown

As its name implies, The Aldridge Co.'s *Tree86 Plus* uses the widely accepted directory-tree representation to depict drive organization and ease movement through the directory structure. *Tree86 Plus* is aimed at intermediate to advanced users; its $99.95 price includes a second product called *Cache86*, a disk cache program that also sells separately for $49.95. If you don't want *Cache86*, *Tree86* is available by itself for $89.95.

Tree86 is a fast program that works with or without a mouse. If you load all the supplied files, it takes up 276K of disk space; it also requires 180K RAM unless you load only essential files, for which it requires 124K. *Tree86* uses just 8K RAM when it launches application programs. Since it maintains directory and file information in RAM (the main reason it's so fast), the maximum RAM requirement depends on the number of drives and files it's tracking. *Tree86* maintains logs for up to 26 drives with more than 16,000 files in 1,000 subdirectories.

Tree86 makes some DOS-command operations simpler, though not all of the more-common ones are duplicated (there's no FORMAT, for example). To issue DOS commands not supported by *Tree86* you can toggle to *TreeDOS* via the slash key; here you can issue all commands except those that change the computer's operational environment, such as SET, PATH, and PROMPT. When *TreeDOS* is running it looks like a usual DOS prompt, but it also displays the time on the right side of the screen. *TreeDOS* isn't an implementation of the DOS alternate command processor; if you want to jump to the alternate COMMAND.COM, just hit the ";" from within *Tree86*. When you exit, you'll come back to *Tree86*.

Tree86 is easy to use and convenient for moving between directories. It lets you delete and move whole directories, including files and subdirectories with their files, but you can only copy one directory at a time. There are several operations you can perform with tagged files; in addition to copying, deleting, and moving sets of them, you can also use tagged sets to limit text searches. *Tree86*'s single-screen view of either directory-tree or file-list windows isn't as convenient as double-column screens, but *Tree86* uses the right side of

Tree86 Plus shows a directory tree or files on the left with drive and system statistics on the right. The top-line menu uses pull-down menus for options. In this screen, *Tree 86*'s Utilities menu lists DOS commands.

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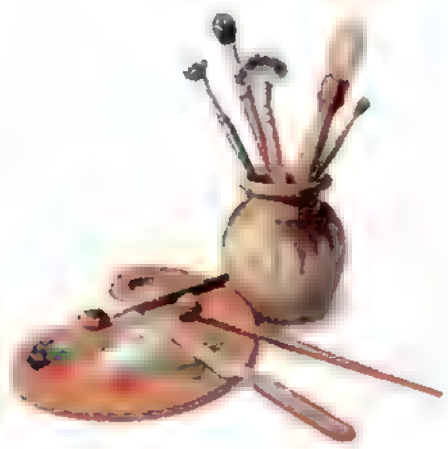

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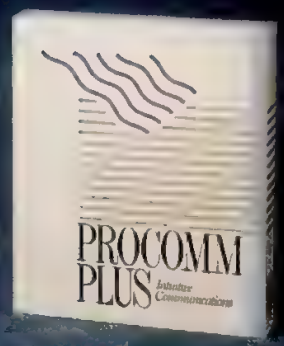

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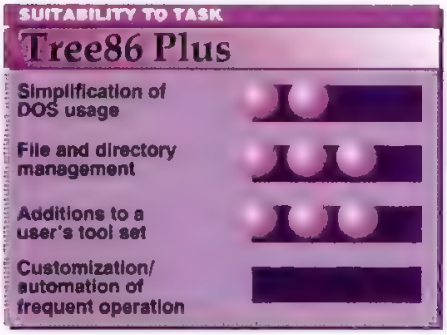
CIRCLE 104 ON READER SERVICE CARD

the screen to display helpful drive, file, and memory statistics.

Tree86 includes a wide range of features including graphic memory mapping, a text editor, and a duplicate feature that finds files on your disk drive with duplicate filenames. There is no macro function, scripting, or menu function. The emphasis is clearly on adding power rather than greatly simplifying DOS, although a



DOS command history maintains a list of the last 32 unique DOS commands issued while in *TreeDOS*.

BARGAIN CACHING

Cache86 is a bargain when included with *Tree86 Plus*. It's a TSR hard disk caching utility with different component programs for conventional, expanded, and extended memory. It also includes a version optimized for the 386 instruction set and 32-bit bus. If you want to check on how well it's all working, a program called C86STATS displays a log of disk read requests and percentages of cache hits.

Tree86 runs other programs very well. From within *Tree86*'s file window you point to a file with a .COM, .EXE, or .BAT extension and execute the RUN option; when you leave the program you'll be back inside *TreeDOS*, where you're prompted to strike any key to return to *Tree86*. (The only limitation is that you're not supposed to start TSR programs while in *Tree86*.) I tried to drive *Tree86* crazy by running various programs and jumping in and out of alternate command processors, but in every case I was left where I should have been, sitting in *TreeDOS*, one keystroke away from *Tree86*.

Tree86 has file viewers for ASCII and hex files and works minimally to view some word processing format files, but this part of the program could use some beefing up.

Tree86 Plus's strongest area is DOS file management. *Cache86* and the utilities and functions included in *Tree86* are weighted toward experienced and knowledgeable power users who want fast action combined with convenient and flexible DOS command access.

***Tree86 Plus*, Version 3.2**
The Aldridge Co., 2500 CityWest Blvd., #575, Houston, TX 77042; (713) 953-1940.
List Price: $89.95; with *Cache86* disk caching utility, $99.95; for *Tree86* alone, $89.95.
Requires: 180K RAM, DOS 2.0 or later.
In Short: *Tree86 Plus* is heaviest on drive and file management and comes with several helpful features such as a flexible disk-caching utility, memory mapping, and a DOS command history. It earns high marks as a power user's DOS shell but it's light on file format viewers.

CIRCLE 616 ON READER SERVICE CARD

Treeview

by Tom Unger

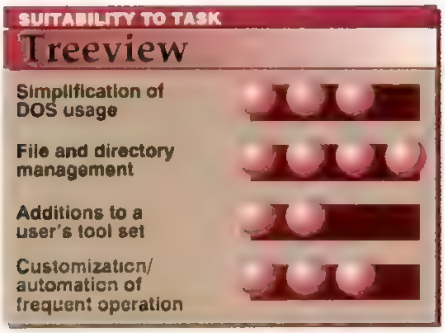
Treeview, Magee's $50 entry into the DOS-shell fray, combines two of the nicest ideas in personal computerdom: a friendlier way to use DOS, and a friendlier way to buy the software. But does this shareware-distributed DOS shell give you everything you need or want in a file- and disk-management program? Almost.

Magee provides no automated installation program, but setup is simple—merely copy three files to a directory you've made for the program, then type TV at your C: prompt, and use your mouse or keyboard to pull down the setup menu, which allows you to customize the program to your specifications. Thorough documentation takes you through the process. However, if you get into trouble, *Treeview* has an online help system that is menu-driven and simple to use.

Treeview is flexible. Want to look at all your files in one long list? *Treeview* can do it. Want to delete entire directories and their associated subdirectories? *Treeview* can do that. Want to move or rename files, subdirectories, or entire directories? You got it. Not only can you set your file-list criteria by file attribute, date, size, and other parameters too numerous to list here, but you can also open as many as six lists with up to 2,515 files in each. Because keeping such large file lists in memory requires a lot of bytes, you can tell *Treeview* to load those windows into EMS. All of these features are available through *Treeview*'s pull-down menus and are accessible through either the mouse or keystroke combinations.

The secret of *Treeview*'s success at simplifying file management is its Microsoft mouse-compatible point-and-shoot interface. The basic necessities of disk monitoring and file management are always on-screen and mouse or keyboard accessible: disk volume label, current path, total number of bytes used and number of free bytes remaining on-disk, number of files in the

Treeview's tree-structured directory marks the current directory in red and the directory where your mouse is pointing in green. The mouse interface is one of the program's best features.



current directory and their combined size, number of files you've tagged and their combined size, your current filter or "mask" (if you're only looking at files with a .DOC extension, for example), and a menu of file-attribute filters from which to choose.

Treeview also provides facilities for using regular DOS functions. You can customize up to 30 keystroke combinations to execute any DOS command, and ten user-definable command macros for more-complex DOS operations. By pointing and clicking, or highlighting with the arrow keys, you can run executable files from any directory on your disk—provided you have the memory, and there's the rub: you may find it impossible to launch certain applications from this shell.

RAM CRAM

In its most miserly configuration, *Treeview* takes a whopping 147K RAM, not including any EMS memory, to remain resident in your computer. This means that even if you don't use any TSRs, you won't be able to launch larger applications, like *dBASE IV*, from inside your DOS shell. Even a word processor like *WordPerfect* 5.0 will be a tight squeeze, and given the fact that *Treeview* comes without an editor or printing facilities, you may find yourself forced to come out of your shell to access some of your most-used applications.

This problem is compounded if you run a large e-mail package such as *Lotus Express* in the background. While some other DOS-shell programs in this roundup are nearly as memory hungry, *Treeview* can't measure up to programs like *Direc-Tree Plus*, which removes all but 4K of itself from RAM when you launch an application. Although no solution has been announced, Magee says it is aware of the problem, and as a policy offers free upgrades to all registered users.

Magee's shareware product may not please memory-hungry power users or those who need to operate large applications, but for those of us who cringe at the idea of managing our files from the naked C: prompt or memorizing lengthy DOS commands, *Treeview* can hold its own with the best of them.

***Treeview*, Version 1.1**
Magee, P.O. Box 1587, Norcross, GA 30091; (800) 662-4330, (404) 446-6611.
List Price: $50.
Requires: 256K RAM, DOS 2.0 or later.
In Short: *Treeview* is an extremely versatile and flexible DOS shell with a superior point-and-shoot Microsoft Mouse-compatible interface. An unfortunate 147K resident memory requirement makes it impossible to launch big-memory applications from inside the shell, thus relegating *Treeview* to use with smaller programs.

CIRCLE 617 ON READER SERVICE CARD

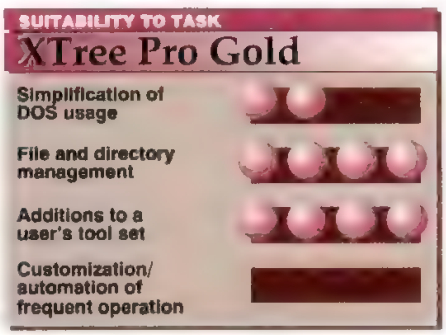
XTree Pro Gold

by Bruce Brown

EDITOR'S CHOICE

Intermediate DOS users, look closely; power users already know about *XTree Pro Gold*'s reputation and value. This DOS shell and disk and file manager for intermediate to advanced users includes an impressive list of tools and DOS enhancers gathered in a cohesive package. If you want speed, flexibility, and power, *XTree Pro Gold* has a lot to offer.

Published by XTree, *XTree Pro Gold* lists for $129. Updates from previous versions cost a reasonable $40. You can run



XTree Pro Gold with any video setup or optionally with any Microsoft-compatible mouse, although the keyboard works just fine. When you install the program it takes 800K of disk space, though you can use as little as 68K if you delete some of the program files. When resident, the program uses almost 180K RAM, but that number drops to just 7K when you launch or open applications.

XTree Pro Gold's main screen serves as a gateway to a variety of other screens and features. The main screen has eight components: a path identification line, a directory tree window, a files window that you can toggle between 24 and 132 file-display capability, a file-specification box where you can enter file specs or wildcards for single or group file operations, the disk-specification box where you identify which one of 26 drives to reference, a statistics box with file and drive size and number data, a DOS command line, and an *XTree Pro Gold* prompt line at the bottom of the screen. You can display two directories and file sets on the screen at the same time and transfer files freely between them.

> With *XTree Pro Gold*, you can display two directories and file sets on the screen at the same time and transfer files freely between them.

You can set the File Window to display all files or just tagged files in the current directory, all directories on the current drive, and all directories on all logged drives. With file tagging you can delete, copy, and move any group of files in your system. *XTree Pro Gold* also has "prune and graft" power to rearrange directory structure from the directory window. Another powerful file feature is the ability to search all files for specific text.

XTree Pro Gold includes two file viewing choices, AutoView and View. With AutoView you can scroll through a directory list on the left of the screen and see the file contents in a large window to the right of the file list. View uses the whole screen

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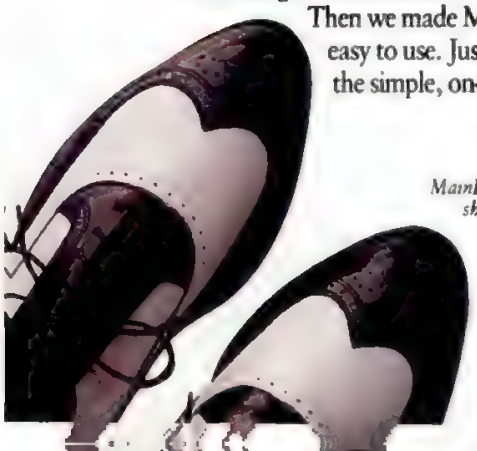

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except for the top-line path, file identification and bottom-screen prompt area. AutoView and View both use *XTree Pro Gold*'s file viewers to show several popular application-created files in their native format. There are viewers for several word processors, *dBASE*, and *Lotus 1-2-3* files.

PROGRAM LAUNCHING

You can start programs in several ways with *XTree Pro Gold*. You can point to .COM, .EXE, and .BAT files and execute them from the file list. You can set up an Applications window as a primitive menu structure. You can launch and load files for whose formats *XTree Pro Gold* has viewers, assuming that the application program is in your system. You can also start programs normally from *XTree Pro Gold*'s ever-present DOS command line.

There are few gimmicks in *XTree Pro Gold*, but there are extra features. The program maintains a history of the last 15 commands issued from the DOS command line. It has a text editor, although like many DOS shells you can set it up to use your own word processor and editor instead. As an enticement to get users to register, XTree sends a file-compression program to those who send in the program registration cards.

XTree Pro Gold isn't appropriate for PC managers or others to set up application menus or DOS-command shells for novices. There's no macro or programming facility. You can use *XTree Pro Gold*'s text editor to edit DOS batch files and run them from *XTree Pro Gold*'s applications menu, but it's not simple enough for be-

XTree Pro Gold's main screen shows a directory tree above file listings for the highlighted directory. Disk statistics appear on the right side of the display, while the available function commands are listed on the bottom. You can also select a split screen to drop the disk statistics and display two trees and file listings.

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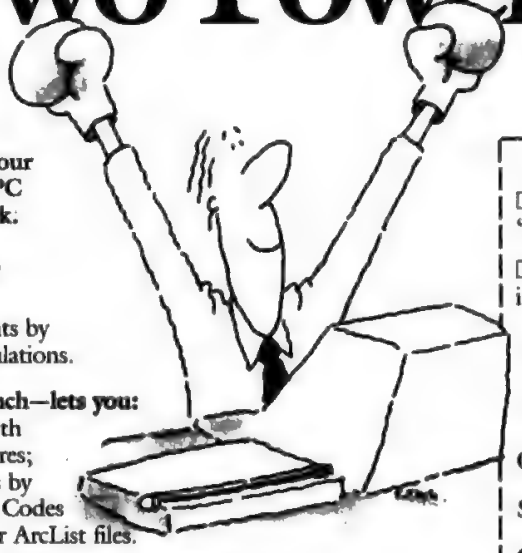

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ginners and to avoid any disastrous accidents or mishaps you probably shouldn't put such potentially destructive tools in beginners' hands anyway.

XTree Pro Gold is fast, flexible, and powerful. It's the best power user's file manager on the market and with its additional DOS-assistance features, it's suitable for intermediate users as well. Beginners should probably stay away, since the same flexibility that intrigues intermediate users and charms experts could confuse and discourage PC newcomers. ■

> *XTree Pro Gold* is a fast, flexible, and powerful program with few gimmicks but lots of extra features, including a file-compression program which is sent to users who send in their registration cards.

***XTree Pro Gold*, Version 1.31**
XTree Co., 4330 Sante Fe Rd., San Luis Obispo, CA 93401; (800) 634-5545, (800) 551-5353 (inside Calif.), (805) 541-0604.
List Price: $129.
Requires: 256K RAM, DOS 3.1 or later.
In Short: *XTree Pro Gold* 1.31 continues its tradition of disk management excellence with a powerful set of utilities to facilitate using DOS and applications software. Best for intermediate or advanced users, this program is fairly easy to use and includes mouse support.

CIRCLE 618 ON READER SERVICE CARD

Bruce Brown is a contributing editor of PC Magazine. *Bill Howard is an executive editor of* PC Magazine. *Abe Rosner is a project leader at* PC Magazine. *Tom Unger is a staff editor of* PC Magazine.

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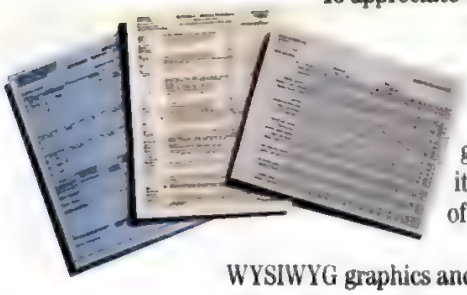

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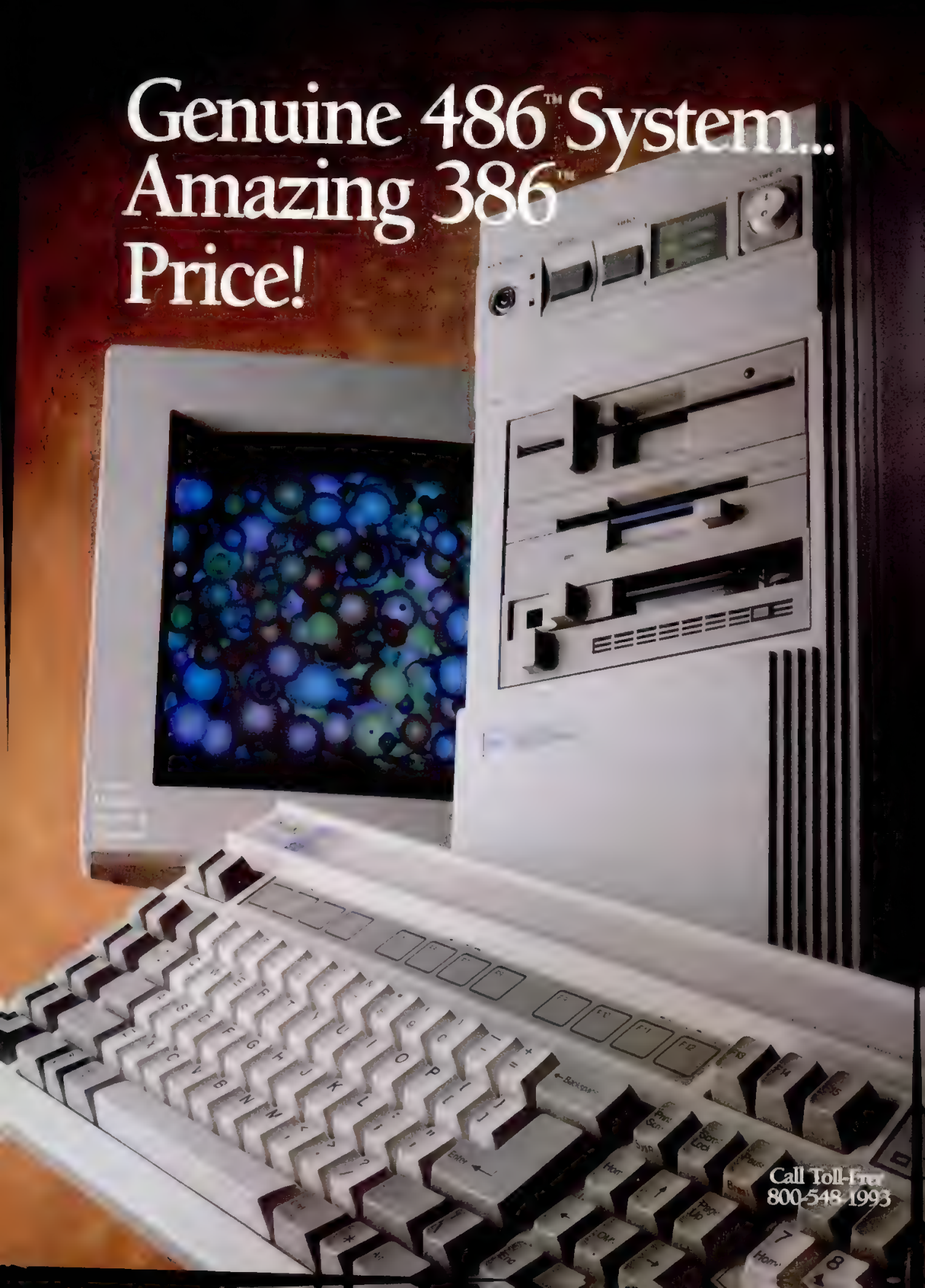
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SCANNERS & PRINTERS

How do some popular and award-winning scanners and printers stand the test of time? Our reviewers dig deep and find out.

ENDURANCE TESTS

by Jennifer Zaino

Getting information into and then back out of your PC is what it's really all about, isn't it? Whether you're scanning a photograph of the Employee of the Month into your company newsletter for output on a 600-dot-per-inch Varityper, or simply scanning in a dog-eared page of text for printing on your LaserJet, the name of the game is information flow.

Recognizing this, *PC Magazine* has devoted plenty of issue space to the scanner and printer arenas. Our last roundup of image and OCR scanners encompassed 21 products, and our 1989 printer blockbuster was our biggest yet, with 109 units passing through the PC Labs. With this issue, we take the opportunity of finding out how the champions of these reviews (and in some cases their successors) have stood up to the test of time.

OUR REVIEWERS

Kellyn S. Betts is a frequent contributor to *PC Magazine*.
Frederic E. Davis is director of PC Labs.
Lori Grunin is a staff editor of *PC Magazine*.
Bill Howard is an executive editor of *PC Magazine*.
Jonathan Matzkin is an associate editor of *PC Magazine*.
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Robin Raskin is a contributing editor of *PC Magazine*.
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Tony Rizzo is senior technical editor of *PC Magazine*.
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Donald P. Willmott is an associate editor of *PC Magazine*.
Jennifer Zaino is a staff editor of *PC Magazine*. ■

As we expected, in the course of this endurance test we uncovered some flaws—a couple of them major, most minor—in some of the units we looked at. The exciting news was how little these systems fell victim to the problems most likely to beset them with extended usage. Take printers, for example. Since the leisurely long-term tests allow time to experiment with such things as envelope-, label-, and postcard-handling capabilities, it wouldn't have surprised us if most of our reviewers had emerged from their offices triumphant at having defeated their devices in at least one of these areas. Yet the complaints we heard were the exception and, for the most part, minor.

So go ahead—scan the information we've compiled from the work of these past months into your own memory. Some day, the opportunity to output it in another form may well offer itself.

SCANNERS

Chinon DS-3000

by Lori Grunin

My tenure with Chinon's DS-3000 overhead scanner was a rocky one. At first, I couldn't get it to work properly with the parallel interface. The documentation was of little help; with the exception of a few troubleshooting tips, it pretty much assumes that everything is working properly, and the technical support staff didn't do much beyond telling me to make sure that the DIP switches and jumpers were configured properly.

I temporarily assumed that the interface board conflicted with another card in my system and decided to go the serial route; no problems surfaced at 19,200 and 9,600 bits per second.

However, I needed to get rid of the big black spots that appeared in my scanned images thanks to the shadow of the scanhead (my office has overhead fluorescent lights). So, to the formerly small-footprint setup I added a small fluorescent desk lamp. Unfortunately, getting an 8.5- by 11-inch page evenly illuminated proved relatively difficult, especially on the fairly reflective paper (magazine stock) I was using. I had to settle for working with pages a piece at a time.

The scanner worked fine with the basic scanning software supplied by Chinon. And with OCR Systems' *ReadRight* (part of a $995 bundle), I had no problem importing a scanned file. However, I couldn't get *ReadRight* to control the DS-3000 scanner directly. A call to OCR Systems' technical support revealed that the package, which is really meant to be used with the parallel card, supports scanning only at speeds up to 9,600 bps. When the software failed to work even at 9,600 bps, tech support did some more digging and found that the problem was with my system: namely, the combination of an old AT BIOS (1984) and a 9-pin serial port (on an old Intel AboveBoard).

That sent me back to the parallel card. After trying the card in a stripped-down machine to verify the conflict hypothesis, I discovered that it still didn't work. When I called Chinon tech support and suggested that the card might be bad, they told me to send it back so that they could take a look at it (they volunteered to do this before they knew I worked for *PC Magazine*). Sure enough, they discovered a broken connection and promptly sent me a new one (at this point they did know my affiliation).

Since then, everything has worked properly, but I can't say I'm terribly enthralled by the scanner. Since the illumination problem makes high-quality full-page scans difficult, a less-expensive hand or half-page scanner probably would have served just as well, given me more gray-scale or dithering options, and taken up less desk space.

Chinon DS-3000
Chinon America Inc., 660 Maple Ave., Torrance, CA 90503; (800) 441-0222.
List Price: $745.
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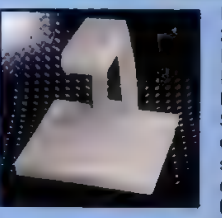
CHINON DS-3000



Last Review: March 28, 1989, page 207
Reason Selected: Editor's Choice
Positive Findings: Small size made it easily transportable, software proved easy to use.
Negative Findings: Difficult to get evenly illuminated scans, not much flexibility in gray-scale scanning.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Hewlett-Packard ScanJet Plus

by Charles Rodriguez

Reasonably priced at $2,190, the Hewlett-Packard ScanJet Plus is an 8-bit graphics scanner that offers a 256-level gray scale and a maximum 1,500-dot-per-inch resolution. Successor to the company's 4-bit ScanJet (an Editor's Choice in our last scanner roundup) with its 16 levels of gray and 300-dpi resolution, this attractive flat-

bed system yielded exemplary performance over the past few months.

Setup was quite painless, requiring only that I install the half-length interface board and parallel cable. Running the SJSWITCH program determined what the interface board's hardware address should be. I particularly appreciated this quick and easy way of avoiding system conflicts at the outset.

Since I began using the unit, it's never failed at producing first-rate images at 256 gray levels. Its flatbed design was a plus over single-sheet scanners I'd used in the past, giving me all the flexibility I needed

to scan from almost any source up to legal-size paper. Magazines, books, banners, postcards—you name it, I tried it (successfully, too!).

For quick text scans using third-party OCR software like *ReadRight*, I indulged the ScanJet Plus's ability to handle rough drafts promptly at low resolutions and 4-bit mode (no problems here). Supplied with the system is the *Scanning Gallery Plus* image editor. One of its most useful features—one that I took advantage of time and again—was its ability to adjust the intensity of the image scanned. Depending on the picture, the default intensity (50 percent) did not always produce the best image.

Scanning Gallery Plus would not have been useful in my routine activities had it not saved images into popular file formats: .PCX, .IMG, .EPS, and TIFF. Support for compressed TIFF format is welcome, particularly when you're using a machine with a 30MB hard disk, as I was.

The program is limited, though—I could cut and paste, zoom, and preview documents for cropping prior to printing,

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CIRCLE 362 ON READER SERVICE CARD

Get Smart. Give Your Laser Printer a Super IQ.

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Get As Much IQ As You Need.

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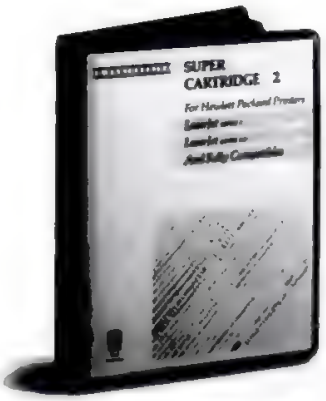

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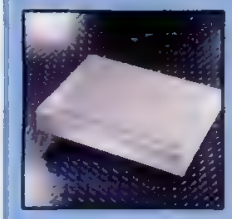
CIRCLE 325 ON READER SERVICE CARD

HEWLETT-PACKARD SCANJET PLUS



Last Review: March 28, 1989, page 222 (ScanJet)
Reason Selected: Market Leader
Positive Findings: Flexible in the sources from which it could scan; easy to use.
Negative Findings: *Scanning Gallery Plus* is nice but limited; *PC PaintBrush IV Plus* was a necessary addition.

RELIABILITY
COMPATIBILITY
PERFORMANCE

but I couldn't manipulate gray shades after scanning, and it was bereft of gray-scale paint tools or a line art pixel editor. For more serious applications, I had to turn to ZSoft's *PaintBrush*. Good news: HP just added *PC Paintbrush IV Plus* to its *Scanning Gallery*/interface bundle.

Other pluses: I was easily able to replace the lamp bulb without having to haul the whole unit into an HP service center. Additionally, various recognition products have lent their support to the ScanJet Plus, including Calera Recognition Systems' TrueScan and Caere Corp.'s OmniPage. I had the opportunity to experiment with both of these products on the system, with generally pleasant results.

Take it from someone with experience: the easy-to-use ScanJet Plus proves a great choice for publishing novices as well as for experts.

Hewlett-Packard ScanJet Plus
Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, California 95014; (800) 752-0900.
List Price: $1,595; Interface card, cabling, *Scanning Gallery* and *PC PaintBrush IV Plus*, $595.
CIRCLE 422 ON READER SERVICE CARD

Kurzweil K-5100 Intelligent Scanning System

by Tony Rizzo

Xerox Imaging Systems' Kurzweil K-5100 Intelligent Scanning System—an upgrade to the K-5000 we reviewed last year—consists of a 400-dot-per-inch flatbed scanner, a 68020 coprocessor board, and software. If the performance this system exhibited in the six months I spent with it is any indication of typical behavior, I'd say that it deserves as much praise as its Editor's Choice–winning sibling.

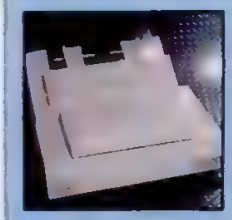
Installation of the coprocessor card required fiddling with port addresses and memory locations (I *do* have a rather full machine) before getting it right. Once in place, though, all went well.

I was surprised at how well the automatic document feeder system was able to handle up to 50 stacked letters that suffered from various ill-defined folds. Occasionally—and as time went on a bit more frequently—the feeder dispatched just-scanned sheets onto the floor rather than into the catch bin. Near the end, I calculated that as much as 20 percent of a 50-sheet stack found its way to the floor. The feeder also had trouble with the last sheet of a stack, often requiring it to be pushed down or readjusted. Over time, the band that pulls sheets into place became skewed and needed to be recentered on its rollers. But these were minor problems.

The proprietary *Intelligent Character Recognition* software, at first almost impenetrable because of a seemingly endless array of options, worked very well. Artificial intelligence features built into the system enabled it to recognize many different type styles. Sure, it turned more than one "m" into "nr" or "rn" combinations, but the good news is that the software let me verify characters as they were scanned, "learning" them along the way. Once it knew the character, it corrected for it in subsequent scans. Over time the documents I regularly scanned required little or no verification.

The software lets you convert scanned text into any one of 18 word processor formats; I converted files into *WordPerfect* 5.0, *Microsoft Word* 5.0, and other programs without problems.

KURZWEIL K-5100 INTELLIGENT SCANNING SYSTEM



Last Review: March 28, 1989, page 258 (K-5000)
Reason Selected: Editor's Choice
Positive Findings: Able to verify and "learn" characters as they're scanned; over time, scanned documents required little verification. Graphics were gorgeous.
Negative Findings: Occasional feeder problems.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Graphics images were gorgeous. From handwriting samples to complex color images, nothing fazed the K-5100. Time after time, each and every one was perfectly captured. (The software supports TIFF, .PCX, .IGF, and .RES file formats.)

Overall, I've had a successful endurance run with the K-5100. The only painful point about the test procedure was acknowledging that if I ever wanted to buy one of these for my very own, I'd have to lay out $17,950. But at least I'd have the consolation of knowing I owned a product that runs rings around the competition without falling apart in the process.

Kurzweil K-5100 Intelligent Scanning System
Xerox Imaging Systems/Kurzweil, 185 Albany St., Cambridge, MA 02139; (617) 864-4700.
List Price: $17,950.
CIRCLE 423 ON READER SERVICE CARD

LASER PRINTERS

Brother HL-8e

by Donald P. Willmott

Built around the same Canon engine as the Hewlett-Packard LaserJet Series II and featuring full LaserJet II emulation, the Brother HL-8e distinguished itself with excellent performance and a full complement of resident fonts and emulations. Over time, the printer has held up just fine and proved to be well worth its $2,895 list price.

In addition to the normal Courier-like fonts in 10, 12, and 15 points, the HL-8e also has a Roman-like font in 12.5, Letter Gothic in 8.5, Helvetica in 10, and Times Roman in 10. Emulations, which are se-

This is the time

Adobe Systems ... NCP
▣ *Streamline Windows 1.0*—Converts your bitmapped images to PostScript format. Imports TIFF, PNT, and PCX formats. Exports to EPS, Illustrator, Corel Draw and Micrografx Designer ..... $229.

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Adobe Systems ... NCP
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6590 ▣ Streamline Windows 1.0 ..... 229.

Aldus ... NCP
1332 □ PageMaker 3.0 ..... 499.

Alpha Software ... NCP
5104 ▣ Alpha Four 1.1 ..... 319.
4103 ▣ Alpha Works 2.0 ..... 89.

Application Techniques ... NCP
1214 ▣ Pizazz Plus 2.0 ..... 69.

Ashton-Tate ... NCP
4450 □ dBASE IV 1.0 ..... 499.

Autodesk ... NCP
4519 □ Autosketch 2.0 ..... 95.
6119 □ Autosketch Animator 1.0 ..... 245.

Avery ... NCP
6006 ▣ Label Pro 1.0 ..... 49.

Bitstream ... NCP
▣ Collections: Newsletters, Flyers, Books & Manuals, Reports and Proposals, Presentations or Spreadsheets *each* 159.
▣ Fontware ..... *each* 99.

Delrina Technology ... NCP
▣ *PerForm 2.1*—New Version! Includes many new features. $30 rebate inside brings your net cost to just $129! ..... $159.

Bloc Publishing ... NCP
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1447 □ FormTool 2.01 ..... 55.
6245 ▣ PopDropPLUS 1.0 ..... 59.
6012 ▣ Print Rite 1.3 ..... 59.

Borland International ... NCP
4330 ⊞ Turbo C Professional Pack 1.0 .... 175.
4332 ⊞ Turbo Pascal Professional Pack 1.0. 175.
6242 ▣ Quattro Pro 1.0 ..... 325.
1514 ▣ Paradox 3.0 ..... 469.

Brightbill-Roberts ... NCP
5408 □ Hyperpad 1.0 ..... 85.

Broderbund ... CP
1434 □ New Print Shop *(NCP)* ..... 39.
1433 ▣ Memory Mate 3.01 *(NCP)* ..... 45.

ButtonWare ... NCP
6419 ▣ PC-File 5.0 ..... 75.

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6004 ▣ Omnipage 386 2.1 ..... 599.

Central Point ... NCP
5039 ▣ PC Tools Deluxe 6.0 ..... 89.
5038 □ Copy II PC 5.0 ..... 27.

Chronos Software ... NCP
4387 ▣ Who•What•When 1.09 ..... $119.

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6575 ▣ R & R Relational Report Writer 3B 109.

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5506 □ CorelDRAW! 1.2 ..... 329.

Crosstalk Communications ... NCP
2908 □ Crosstalk XVI 3.7 ..... 119.
5611 □ Crosstalk for Windows 1.0 ..... 129.

Data Storm ... NCP
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2762 □ Mace Utilities 1990 ..... 89.
3950 ▣ Fastback Plus 2.1 ..... 109.

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5810 □ FormWorx with Fill & File 2.5 .... 85.

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6188 ⊞ FoxPro 1.0 ..... 489.
2233 ⊞ Foxbase Plus 2.1 ..... 199.

Funk Software ... NCP
2228 □ Sideways 3.21 ..... 42.
4479 □ Allways 1.2 ..... 115.

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5825 ▣ Money Matters 1.0 ..... 55.

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Lotus ... NCP
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MECA ... NCP
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7002 ▣Home Lawyer 1.0 ..... 69.
Microcom ... NCP
6234 ☐CarbonCopy Plus 5.2 *(2 req.)* ... 115.
Micrografx ... NCP
6294 ▣Draw Plus 1.0 ..... 289.
Micro Logic ... NCP
2968 ☐Tornado 1.8 ..... 55.
6787 ▣Info Select 1.1 ..... 55.
Microlytics ... NCP
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Microsoft ... NCP
2860 ☐Learning DOS 2.0 ..... 35.
2899 ☐Windows 286 2.11 ..... 69.
2904 ☐Works 2.0 ..... 99.
2901 ☐Word 5.0 ..... 209.
6195 ▣Word for Windows ..... 329.
2856 ▣Excel 2.1 *(req. 80286/80386)* ... call
6133 ▣Excel for OS/2 1.0 ..... 339.
5188 ☐QuickPascal 1.0 ..... 55.
2894 ☐QuickBASIC 4.5 ..... 69.
2895 ☐QuickC 2.0 ..... 69.
2853 ▣C Compiler 6.0 ..... 339.
Multisoft ... NCP
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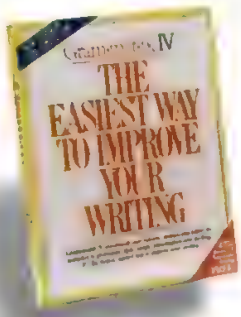
4925 ☐PC-Kwik Power Pak 1.5 ..... 79.
Nolo Press ... NCP
2982 ☐WillMaker 3.0 ..... 35.



Reference Software ... NCP
▣*Grammatik IV 1.0*—Checks for grammar, style, usage, punctuation and spelling errors in one pass! Now works within WordPerfect 5.1, Microsoft Word 5.0, Professional Write 2.1, WordStar 5.5, XY Write III & more.... $52.

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Precision Software ... NCP
6600 ▣Superbase 4 for Windows ..... 449.
Quarterdeck ... NCP
6422 ☐QRAM 1.0 ..... 49.
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Reality Technologies ... NCP
6572 ▣WealthBuilder 1.01 ..... 145.
Reference Software ... NCP
4396 ▣Grammatik IV 1.0 ..... 52.
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RightSoft ... NCP
4155 ▣RightWriter 3.1 ..... 54.
Samna ... NCP
5799 ▣Ami Professional 1.0 ..... 309.
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3496 ▣Professional Write 2.12 ..... 149.
3493 ☐Professional File 2.01 ..... 199.
3482 ☐Harvard Graphics 2.13 ..... 339.
6289 ▣Draw Partner 1.0 *(for Harvard Graph.)* 59.
Symantec ... NCP
3412 ▣Grandview 1.0 ..... 199.
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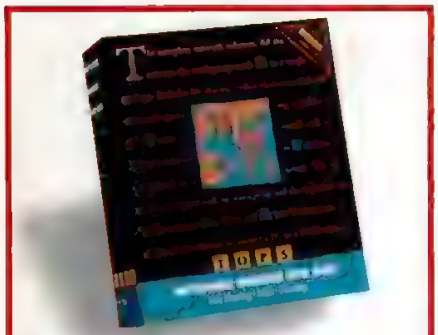

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6771 ▣Memory Master 1.0 ..... 45.

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3804 ☐WordPerfect 5.1 ..... 265.
6685 ▣DrawPerfect 1.0 ..... 279.

WordStar International ... NCP

2825 ☐WordStar Prof. 6.0 ..... 279.
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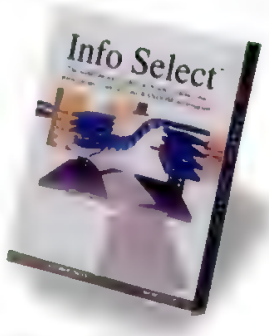
Xerox ... NCP

3812 ☐Ventura Publisher 2.0 ..... 529.

XTREE ... NCP

6161 ▣XTreePro Gold 1.3 ..... 75.



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5851 ▣SimCity ..... 33.

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6436 ▣Hunt for Red October ..... 20.
4659 ▣Chessmaster 2100 *(CP)* ..... 35.
5804 ▣Deluxe Paint II *(Enhanced)* ..... 89.

Microprose ... CP

4454 ☐F-19 Stealth Fighter ..... 39.
5823 ☐Red Storm Rising ..... 39.

Microsoft ... NCP

2858 ☐Flight Simulator 4.0 ..... 39.

Parlor Software ... CP

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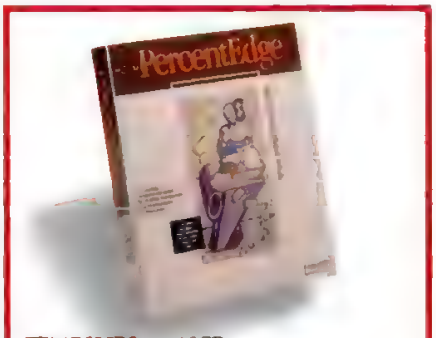

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☐*PercentEdge 1.0*–Calculate mortgage rates, present values, annuities, savings and loan balances, and more. Fill in the blank interface completes the calculation once sufficient data is entered. "Pop-up" mode available .. $69.

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3435 ▣My Letters, Numbers, Words *(2 to 6)* 22.
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3439 ☐2nd Math *(ages 7 to 16)* ..... 27.

True BASIC, Inc. ... NCP

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Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

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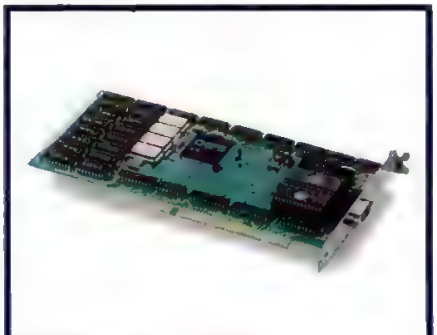
6812 200DL *(stand-by power source)* .. 155.
6811 360SX *(stand-by power source)* ... 255.

AST Research ... 2 years

1299 SixPakPlus 384k C/S/P ..... 187.



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VGA–(640 x 480) 16/8-bit ..... 119.

6795 SixPak 286 512k ..... 209.
4107 RAMpage Plus 286 512k ..... 419.
4105 RAMpage Plus Micro Channel 512k 419.

Boca Research ... 5 years

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7000 TophAT *(16-bit backfill 512K to 640K, with 0K)* ..... 79.
6998 I/O Board for AT ..... 59.
6999 I/O Board for Microchannel S/S/P . 109.

Brother International ... 1 year

5787 HL-8e Laser Printer ..... 1799.
5788 HL-8Ps PostScript Laser Printer . 2949.

Compucable ... 2 years

1604 2-Position switch box ..... 25.

Cuesta ... 1 year

1608 Datasaver 400 Watt *(power backup)* 429.

Curtis ... lifetime

1694 Emerald SP-2 ..... 36.
1707 Ruby SPF-2 *(6 outlets)* ..... 55.
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2346 Inboard 386/PC w/1 Meg *(w/free Ami)* 519.
4266 Above Board Plus 512k ..... 419.
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5342 Above Board Plus 8 I/O 2 Meg ... 629.
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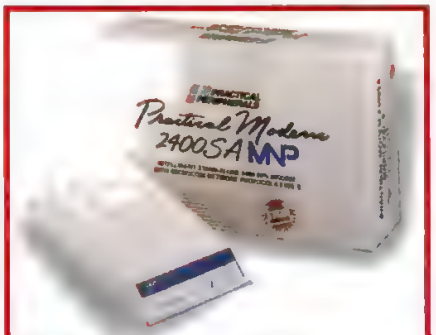

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(Or, how we mind our Peas & Cukes.)

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lected off the slightly inscrutable but ultimately functional 8-button LCD front panel, include HP LaserJet II, HPGL, Diablo 630, Epson FX-80, IBM Proprinter XL, and Twinwriter DP and WP. All of these worked well, and getting them right off the front panel was convenient.

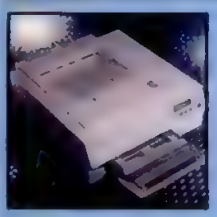
As for the output, it was as good as I'd expected, given the well-documented excellence of the Canon engine. Normal text consistently came out fast and crisp; the condensed spreadsheets I printed sideways were easy to read; and the proportional spacing of the Roman-like font gave a formal look to my important documents.

One good test for a printer is to use software to make lots of labels, big and small. My six-point return address tags made with Avery's *LabelPro* came out as sharp as the antisocial 76-point "Do Not Disturb" sign I made for my office door, and the printer had no trouble handling thick sheets of labels. Envelopes sailed through smoothly as well.

Even the pieces of a six-foot banner generated with Broderbund's *Print Shop* featured dark, consistent black areas. More important, the blackness of the black held up remarkably well over the months despite the volume of graphics projects I printed.

Though somewhat cryptic in spots, the printer's 368 pages of documentation are complete. Does a laser printer really need this many pages of explanation? Having turned to them often throughout the endurance test, I would have to say yes—when the printer is as full-featured as the HL-8e.

BROTHER HL-8e



Last Review: November 14, 1989, page 118
Reason Selected: Editor's Choice
Positive Findings: Crisp, speedy output in a wide variety of standard fonts and emulations.
Negative Findings The front panel could be less complicated, but the LCD readout is a big help.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Brother HL-8e
Brother International Corp., 200 Cottontail Lane, Somerset, NJ 08875-6714; (800) 284-2844.
List Price: $2,895.
CIRCLE 424 ON READER SERVICE CARD

Brother HL-8PS

by Pamela Milland

Take a "me, too!" Canon engine, throw in Hewlett-Packard LaserJet II and PostScript emulation, add scalable fonts, and you get the Brother HL-8PS. The PostScript emulation moves this printer a step beyond its otherwise close relation, the Brother HL-8e. Ever since the versatile $4,495 HL-8PS took over from my HP LaserJet II, it has been showing itself an appealing performer.

One of the things I appreciated over the long term was the ease with which I could change orientation, emulation, number of copies, and other factors. For instance, I had only to press a few buttons on the front control panel, and spreadsheets that once printed in portrait mode would then print out in landscape orientation. But I must admit that before I became completely familiar with the panel, I did have to thoroughly peruse the manual.

During the testing period, I used lots of standard software packages—*PageMaker, 1-2-3, Microsoft Word*—in both BR Script (Brother's proprietary PostScript emulation) and HP LaserJet Series II emulation. Even after long months of constant use I was not disappointed in the crisp, black images and type fonts that came shooting out of the printer. All 12 BR Script font families performed amiably, and a Microsoft 1 font cartridge used in HP mode also produced quality documents.

The only glitch in six months of continuous use was attributable to my own error but compounded by a cryptic error message. After printing out a document in BR Script, I tried to print from a non-PostScript software package. The message "Ignore Data" appeared on the front panel, but no explanation of it was found in the manual. The easily diagnosed problem was that I was using the wrong emulation mode, but Brother could really idiot-proof its printer if it changed this one error message to something more meaningful or included a reference to it in the otherwise extensively helpful manual.

BROTHER HL-8PS

Last Review: November 14, 1989, page 120
Reason Selected: Editor's Choice
Positive Findings: Excels in both HP LaserJet Series II and PostScript modes, output never lost its crisp appearance
Negative Findings: Documentation extensive, but a cryptic error message was left unexplained.

RELIABILITY
COMPATIBILITY
PERFORMANCE

The printer came standard with 2MB of RAM. Though I don't routinely download enough fonts to warrant more than that, Brother does let you increase the memory to 6MB via an easily installable expansion board.

Finally, what higher praise could I give to a printer than to say that it even prints standard-weight, business-size envelopes easily? I certainly put the HL-8PS to the test in this area and was happily rewarded by its unfailing performance every time.

Brother HL-8PS
Brother International Corp., 200 Cottontail Lane, Somerset, NJ 08875-6714; (800) 284-2844.
List Price: $4,495.
CIRCLE 425 ON READER SERVICE CARD

Hewlett-Packard LaserJet IID

by Jonathan Matzkin

It took only minutes—not months—after Hewlett-Packard's LaserJet IID was deposited into my hands for me to realize its value in particular installations. With its ability to print on both sides of a page (duplex printing), it is indispensable to any organization that frowns upon paper waste or needs a flexible performer that offers heavy-duty paper handling in either personal or networked situations. A PostScript option could make it even more

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CIRCLE 329 ON READER SERVICE CARD

valuable in certain settings.

Installing the IID is little different from the setup procedure for any other LaserJet. One major difference, though, is the machine's physical presence: this thing is *large*. It weighs in at a chubby 74 pounds and has a formidable 12.3- by 18- by 35-inch (HWD) footprint. That rules out desktop placement. I plunked mine down on a separate table adjacent to my desk, and there were times during the months I used it when I genuinely wished it weren't so big. Any potential user should carefully compare the advantages of duplex printing and flexible paper handling against the liability of the LaserJet IID's heroic proportions.

Unlike the LaserJet II, which offers a single paper-feed cassette, the IID supports up to two cassettes, as well as an optional, top-mounted envelope feeder. With the proper software, I was able to access these paper sources in a variety of combinations and sequences. I could, for instance, print the first page of a letter on company letterhead (fed from one bin), then switch to plain bond paper (fed from the second bin), and top the whole thing off with an envelope fed from the top-mounted sheet feeder.

When installed with Laserjet II drivers, the IID worked fine with my favorite software applications. Selecting duplex printing through the system's front panel was so easy to do that I found it very convenient to turn the feature on and off as a particular job demanded.

HEWLETT-PACKARD LASERJET IID

Last Review: November, 14, 1989, page 150
Reason Selected: Editor's Choice
Positive Findings: Flexible paper handling with two paper cassettes and optional envelope feeder; offers the advantage of duplex printing.
Negative Findings: Large and heavy, it could be cumbersome in tight areas.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Of course, accessing the IID's complete font and feature set and selecting duplex printing from software require actual IID drivers. Presently, *Windows*, *WordPerfect* and *Microsoft Word* drivers are among those available. Lack of some other IID-specific drivers could be a problem on networks, where the duplexing feature would be most conveniently selected through software.

The Laserjet IID is not for everyone. It's expensive ($3,595), physically cumbersome, and, apart from duplex printing and flexible paper-handling, not all that different from other lasers. But in my experience, its extended capabilities performed without a hitch; if they're what you need, it's worth the expense.

Hewlett-Packard LaserJet IID
Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900.
List Price: $3,595; PostScript option (specific to IID), $995; PostScript option (for IID, IIP, and III), $695.

CIRCLE 426 ON READER SERVICE CARD

Hewlett-Packard LaserJet IIP

by Lori Grunin

I have very little to say about the diminutive Hewlett-Packard LaserJet IIP. Why? Because after six months, it works—with no fuss, no bother—exactly as advertised. The 4-page-per-minute IIP, which lists for $1,495 (with a street price of around $1,000), proved to be a sturdy printer that's easy to set up and use.

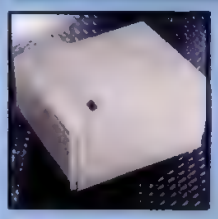
Initially, setting up and getting started with it took me about 10 minutes, with infrequent reference to the documentation. In fact, the only time I really needed the manual throughout the test period was for looking up control codes to use with *XyWrite*.

I used the IIP primarily for printing text, using both internal and cartridge fonts and the occasional small graphic. The print quality is as good today as the first time I saw it, with no sudden appearance of streaks.

Although it doesn't have a straight-through paper path, regular-weight business envelopes went through with a minimum of wrinkling on the faceup output path. If you use Hewlett Packard's instructions for printing envelopes from the manual feed tray, you have to hit the on-line button—a small annoyance that I bypassed by not telling the printer I was feeding it envelopes.

For my daily work, I was very glad I had the optional cassette tray ($195), which sits underneath the printer. In addition to holding not nearly enough paper (50 pages), the extender for the manual feed tray tended to retract, causing the paper to backflip out and land on the floor. The paper would also get dusty and dirty from constant exposure. Furthermore, with the manual and faceup output trays extended, the small-footprint printer didn't seem so small anymore, and I kept bumping into the protrusions.

HEWLETT-PACKARD LASERJET IIP



Last Review: November 14, 1989, page 152
Reason Selected: Editor's Choice
Positive Findings: Consistently nice output, well-designed front panel controls made it very easy to use.
Negative Findings: Manual paper-tray extender tended to retract, dumping paper onto the floor.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Before it landed on my office doorstep, the IIP had undergone testing for other issues of the magazine and emerged unscathed. As further testament to the petite system's sheer physical durability, I repeatedly buried it under other equipment, unplugged it, and moved it around (all the hardware in my office undergoes the same torture). The printer got dirty, but that's about all.

An important addendum to all this is that a PostScript option designed to work in the LaserJet IIP, IID, and III printers should be available by the time you read this article.

Printers and I have a longstanding love-hate relationship: they love to make me hate them. But unlike its less-friendly brethren, the IIP has been so straightforward and easy to use that I'll actually be sorry to see it go.

Hewlett-Packard LaserJet IIP
Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900.
List Price: $1,495. Cassette tray, $195. PostScript option for IIP, IID, and III printers, $695.

CIRCLE 427 ON READER SERVICE CARD

If you use PC's in your business, they may be hindering operations instead of helping you run your business better. Your people may be walking data from one PC to another, then waiting for the few available printers. You're on a Sneaker Net system – and it's impeding getting things done, costing you time and money and hurting more than your feet. Now is the time to consider NEXOS, from DSC.

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CIRCLE 243 ON READER SERVICE CARD

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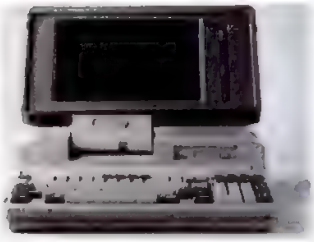

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The Dell System® 316LT laptop.

Other laptops pale by comparison. An opinion shared by *PC Magazine,* which recently named the Dell System 316LT Editor's Choice.

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Inside this sleek design there's an intense 16 MHz 386™ SX system with up to 8 MB of RAM, a 20, 40 or 120 MB hard drive, and a 3.5" 1.44 MB diskette drive.

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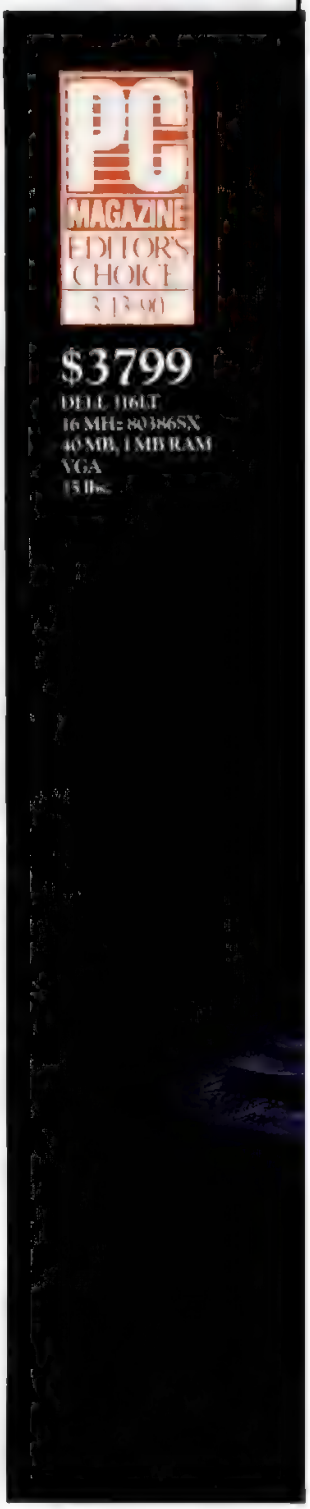
Everything you now enjoy on your desktop, in a laptop. *For under $3500 for a 20 MB system.* With leasing plans as low as $127 a month.**

The Dell System 316LT also comes with support and service rated #1 in 6 out of 6 *PC Week* polls of customer satisfaction, a 30-day money-back guarantee, and one-year of on-site service. So if you ever have a problem while you're on the road, there'll be a technician from Xerox Corporation, there to service it by the next business day.△ Anywhere in the continental U.S.

Give us a call and we'll go into the details with you.

So much for business travel being dull.



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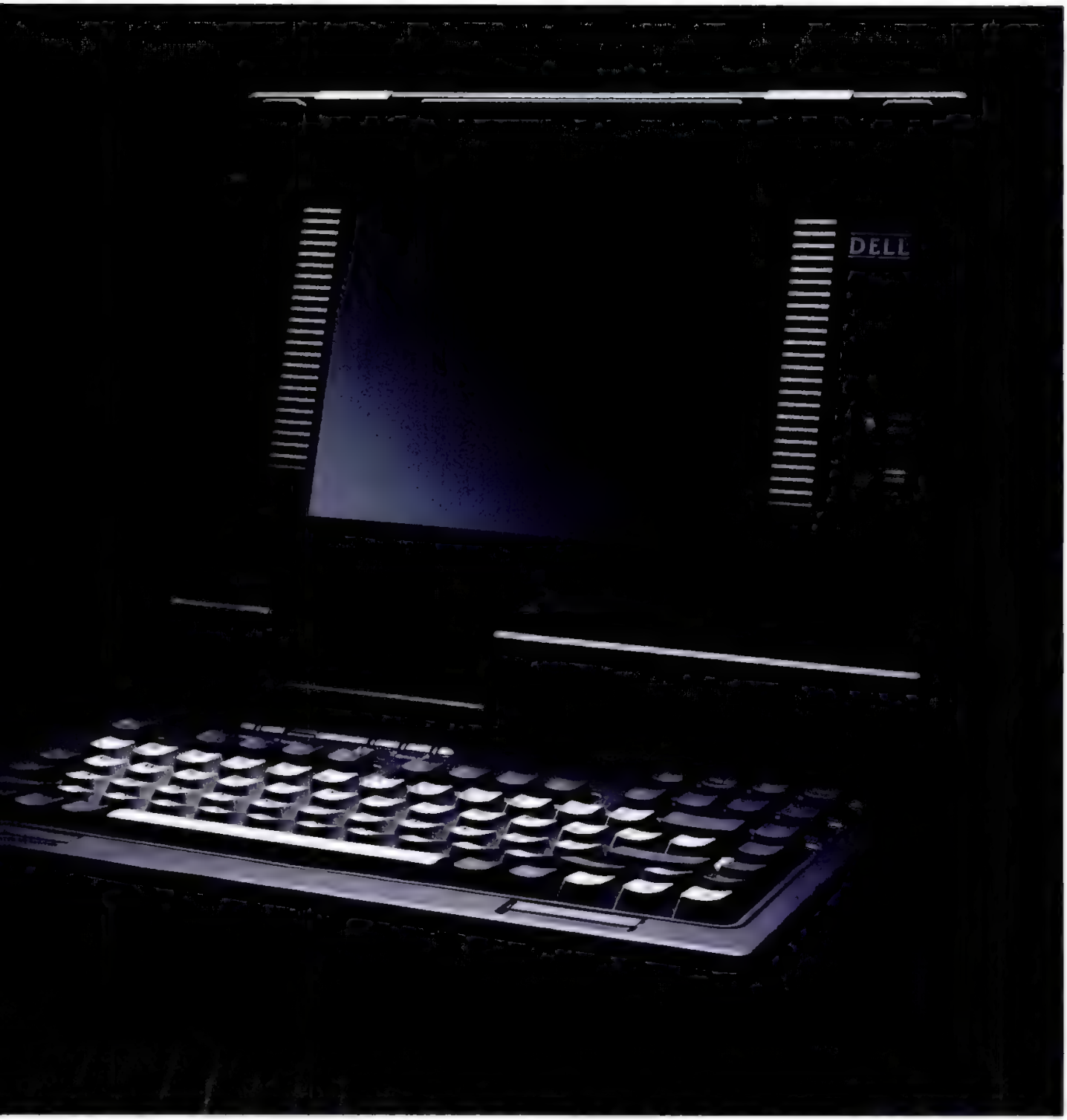
S. DELL



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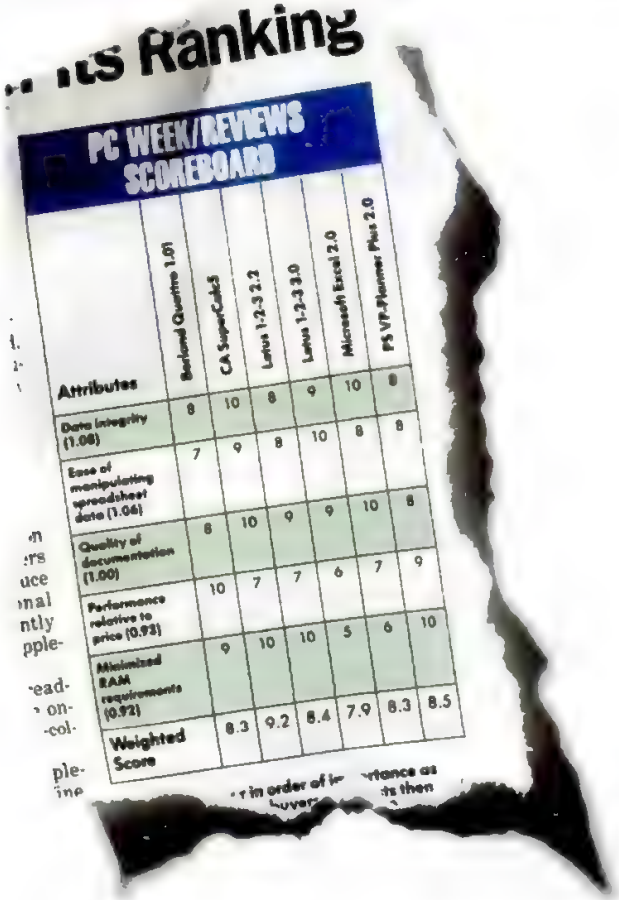
AD CODE 11B58

CIRCLE 532 ON READER SERVICE CARD

Perhaps The Best Way To Choose A Spreadsheet Is By The Numbers.



PC WEEK/REVIEWS SCOREBOARD

Attributes	Borland Quattro 1.01	CA SuperCalc5	Lotus 1-2-3 2.2	Lotus 1-2-3 3.0	Microsoft Excel 2.0	PS VP-Planner Plus 2.0
Data integrity (1.08)	8	10	8	9	10	8
Ease of manipulating spreadsheet data (1.06)	7	9	8	10	8	8
Quality of documentation (1.00)	8	10	9	9	10	8
Performance relative to price (0.93)	10	7	7	6	7	9
Minimized RAM requirements (0.92)	9	10	10	5	6	10
Weighted Score	8.3	9.2	8.4	7.9	8.3	8.5

In a spreadsheet world filled with personal opinions, misleading claims, and advertising hype, you may want to consider what an objective third party has to say.

Like *PC Week,* who recently conducted a comparison of all the top spreadsheets and found SuperCalc®5 to be the best.

By far.

"To use it is to love it," they said. And they are not the only ones who feel that way. *PC Computing* says SuperCalc5 delivers "spectacular performance." And *PC Resource* sums it up nicely by calling it "spreadsheet heaven."

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IBM LaserPrinter

by Frederic E. Davis

Having pumped tens of thousands of pages through many different lasers over the past five years, I know how to push a printer to its limits. This endurance test presented an irresistable challenge to find the weak spots in a product that won both our Editor's Choice and Technical Excellence awards—the $2,395 IBM LaserPrinter.

However, spending the fall and winter with this system turned out to be pretty dull. Like a boring but reliable friend, it did everything it was supposed to do with no suprises. I ran various types of paper, labels, and envelopes through with only one jam-up relating to a piece of very thin paper. On most printers, it's usually envelopes or labels that cause the worst jams, but IBM's envelope feeder worked better than any other I've tried, and the printer allowed me to send sheets of labels through in a straight path, keeping them from getting stuck inside. Even recovering from the one jam was a breeze: the top pops open easily and exposes the paper path in a way that makes it simple to pull out the jammed sheet without tearing it or getting toner all over yourself.

Not only was removing the jammed sheet a snap, but it was easy to work with virtually all the physical components of this printer. For example, when you open the top, a special mechanism moves the toner cartridge into an accessible position—in fact, the printer practically hands the toner cartridge to you. Replacing the cartridge is as simple as lifting out the old one and putting in the new.

The only hardware design aspects that fell short of the mark were the front control panel and the font cartridges. I found the panel and its display to be intuitive for some operations but confusing for others. The credit-card-size font cartridges are small and convenient but if I wasn't paying attention, it was easy to insert them upside down. Doing so didn't damage anything, it just caused some confusion.

Other than that, the IBM LaserPrinter has proven to be a solidly built, well-designed, very compatible, hassle-free printer that is about as good as a 300-dot-per-inch laser gets. I like the printer so much—especially the reliable envelope-handling—that I wouldn't hesistate to make it a permanent part of my system.

IBM LaserPrinter
IBM Corp. (contact your local authorized IBM dealer); (800) IBM-2468, ext. 130.
List Price: $2,395.
CIRCLE 428 ON READER SERVICE CARD

IBM LASERPRINTER

Last Review: November 14, 1989, page 156
Reason Selected: Technical Excellence, 1989
Positive Findings: Unmatched envelope and label handling; easy jam recovery and toner cartridge access.
Negative Findings: Panel controls sometimes confusing; font cartridge insertion difficulties.

RELIABILITY
COMPATIBILITY
PERFORMANCE

QMS PS-2200 Model S

by Bill Howard

The QMS PS-2200 Model S is to other laser printers what a tuba is to trumpets: same general idea, only bigger and with more noticeable output. The PS-2200 provides PostScript printing on B-size (11- by 17-inch) paper, as well as on 8.5 by 11. I quickly found a raft of uses for this 107-pound incredible hulk, most frequently as the ultimate spreadsheet enhancer. B-size paper allowed me to generate highly readable 70-row, 25-column spreadsheets in *Excel* without resorting to Scotch tape to piece together four smaller sheets.

Among the other ways I put the PS-2200 to work was printing draft documents with large borders for workgroup markup, outputting floorplans and CADD drawings, making quick signs and posters, and print-previewing double-page brochures. It's also useful for making the equivalent of 600-dot-per-inch DTP masters for copy shop reproduction: compose 300-dpi pages at 200 percent of normal size, then have the print shop reduce them by 50 percent. That gives halftones an effective 75-dpi resolution, about what you'd find in a newspaper.

QMS claims a speed of 22 pages per minute; we found a shade under 14 with A-size paper and about 9 ppm with the larger sheets. Reliability was good, with two exceptions: after seven months, streaks marred the output. These disappeared after repairs (on-site) to the paper transport mechanism. Also, paper jams occurred on the order of two or three per thousand sheets—not often, but more often than on HP LaserJet IIs.

With a duty cycle of 20,000 pages per month, the PS-2200 Model S belongs on a network, perhaps in the ratio of one for every dozen A-size laser printers. Our $12,995, 35-font (genuine Adobe PostScript, Version 51.0 C) Model S test unit had two 250-sheet paper trays and a third bypass tray; QMS now offers a single-cassette (plus bypass tray) PS-2200 Model B for $3,000 less. Based on the overall ruggedness, usefulness, and print quality of our QMS long-term test unit, you're likely to find you'd benefit from one, too.

QMS PS-2200 Model S
QMS Inc., P.O. Box 81250; Mobile, AL 36689-1250; (800) 631-2692 ext. 723; (205) 633-4300 ext. 1253.
List Price: $12,995.
CIRCLE 429 ON READER SERVICE CARD

QMS PS-2200 MODEL S

Last Review: November 14, 1989, page 176
Reason Selected: Editor's Choice
Positive Findings: Speedy PostScript output on 11 by 17 and 8.5- by 11-inch paper; rugged.
Negative Findings: Test unit jammed occasionally and needed minor repair to maintain print quality.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Varityper VT600W

by Gus Venditto

When I agreed to give the Varityper VT600W a six-month run last fall, I had more than a journalist's interest in the printer's performance. I had recently signed a requisition order for the $22,995 PostScript device that would supply our production editors with 600-dot-per-inch proofing copies of the magazine's pages in progress. It's with extreme relief (and renewed job security) that I'm giving the machine a clean bill of health.

Necessarily, my requirements for this

VARITYPER VT600W

Last Review: November 14, 1989, page 197 (VT600P)
Reason Selected: Editor's Choice
Positive Findings: Provides workhorse PostScript service with crisp output at 600 dpi.
Negative Findings: Slow in printing graphics.

RELIABILITY
COMPATIBILITY
PERFORMANCE

printer were more demanding than just getting sharp copies of correspondence. Our four production editors are always poring over pages, making sure that diagrams are accurate and proofreading seven-point type on a daily basis. The printer has been in almost constant use from 9 in the morning until 6 at night, printing diverse typefaces and giving a full workout to PostScript's variety of halftone shades.

The only real problem concerning printing was outside the VT600W's control. Jobs sent to the printer were sometimes lost in limbo, but that was because our twisted-pair token-ring network was being hit with static. Additionally, impatient editors sometimes found the wait interminable, but we expected as much from a 600-dpi PostScript device. The Editor's Choice VT600P (identical to the endurance test model except that it's limited to 8.5- by 11-inch paper while the VT600W has 11 by 17 capability) had scored 0.5 graphics pages per minute during our printer roundup last fall, about one-third the speed of an HP-compatible 300-dpi laser printer.

There was never a compatibility problem with *Microsoft Windows* drivers or PostScript programs. Print quality also stayed high over six months of use, thanks to quarterly visits from Varityper's technician (we opted to keep the machine under service contract). And the staff has just about gotten used to the half-dozen print-status icons that seemed overly abstract (a rounded U means the machine is printing).

Overall, we're happy with it. While the initial cost of the system is high, it's already paid for itself in typesetting savings.

Varityper VT600W
Varityper Inc., 11 Mt. Pleasant Ave., East Hanover, NJ 07936; (800) 631-8134.
List Price: $22,995
CIRCLE 542 ON READER SERVICE CARD

COLOR PAGE PRINTERS

QMS ColorScript 100 Model 10

by Jerry Tortorella

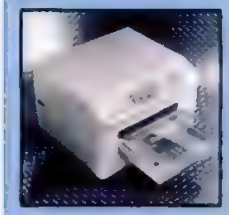
Familar with the old adage, "Good things come in small packages"? Well, the folks at QMS certainly must be: they're packing an enormous amount of power into their space-conservative, 11- by 17- by 25-inch (HWD) color page printer. During this test, the $9,995 ColorScript 100 Model 10

has repeatedly demonstrated that it's well worth its cost.

Admittedly not a printer expert, I encountered problems during setup. Initially I tried to add the printer through the *Windows* Control Exec panel; it responded by spooling and crashing. Tech support advised me to load *PS Executive* (from Laser Connection, a QMS subsidiary) to set handshakes and baud rates, among other things. Success!—or so I thought. While the printer admirably handled basic graphic shapes that didn't involve text or gradations in color, the minute I added these features it again spooled and crashed. More experimentation ensued, with the end result being the removal of *PS Executive* from my system and the realization that I must have previously made the wrong moves in *Windows*. While QMS's tech support was helpful, it would have saved me time if they had hit upon the possiblity of an incorrect *Windows* configuration at the outset.

No matter, though, because now the

QMS COLORSCRIPT 100 MODEL 10



Last Review: November 14, 1989, page 217
Reason Selected: Editor's Choice
Positive Findings: Print complicated raster- and vector-based graphics.
Negative Findings: It emitted a constant noise in idle mode that made holding a conversation anywhere near it annoying.

RELIABILITY
COMPATIBILITY
PERFORMANCE

printer was performing beautifully, printing out complicated 2MB raster and vector-based graphics files without a whimper. The colors were vibrant and rich, great for presentations and comps. The QMS follows standard pre-press methods of laying the colors on top of one another, angling the dots for each color layer of cyan, yellow, magenta, and black. This means that I got only slight color variance (about 10 percent) between Model 10 output and industry-standard color guides like the Pantone Matching System.

As *PC Magazine*'s art director, I spend a lot of time proofing layouts and graphics; the maximum 8.5- by 14-inch output was fine for these basic color needs. We never print two facing pages on a single sheet, so doing without the larger 11- by 17-inch printout that QMS's ColorScript 100 Model 30 is capable of was not a sacrifice. One thing to note, though: to achieve 8.5- by 14-inch color output, you'll need 5MB of RAM; the system ships with only 4MB. The extra megabyte costs $595.

One invaluable feature is its ability to interact with the PC. Through the printer's COM port, you can go interactive with the PostScript interpreter, allowing for PostScript code debugging.

An important issue to consider when evaluating a product like this over the long term is not only how well it meets its goals, but how much money it helps you conserve. Just by using the color printouts as a replacement for the color keys our prepress house would normally make, we've realized big savings—and that translates into a big recommendation.

QMS ColorScript 100 Model 10
QMS Inc., P.O. Box 81250, Mobile, AL 36689-1250; (800) 631-2692 ext. 723, (205) 633-4300 ext. 1253.
List Price: $9,995; 1MB upgrade, $595.
CIRCLE 543 ON READER SERVICE CARD

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Room to grow. *The JX-9500 with automatic envelope feeder and second paper tray.*

It's also ready to grow. Add a second paper tray for a full 500 sheet capacity. Or an automatic envelope feeder that handles 40 envelopes without forcing you to take the paper out. There are *two* font card slots. And memory is expandable to 4.5MB with easy-to-install RAM cards.

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CIRCLE 193 ON READER SERVICE CARD

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perts will be this year.

And, with the resolution coming in at a mind-reading 400 points per inch, cornering, stopping and starting are second nature.

What it means is you can race through even the most complicated software programs without hesitation.

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INK JET PRINTERS

Hewlett-Packard DeskJet Plus

by Rock Miller

The $995 Hewlett-Packard DeskJet Plus emerged from our endurance trial with the same solid impression it gave when it entered it. Once you've figured out where to plug in the cables, the printer works as it should—smoothly and inconspicuously.

It's a relatively leisurely performer, but its silence makes it a good office mate. And despite its polished appearance, it proved rugged. It showed no evidence of overheating even after having been left on for days at a time, and its well-designed and sturdy paper-feed mechanism didn't jam even once.

The paper tray is one of the DeskJet's real assets. Since it takes both letter and legal-size sheets and feeds from the top of the stack, I could easily slip in a piece of letterhead without unloading it. It even has a nifty envelope-feeding mechanism, though the tray was too narrow for long business envelopes.

HEWLETT-PACKARD DESKJET PLUS

Last Review: November 14, 1989, page 268
Reason Selected: Editor's Choice
Positive Findings: Excellent print quality; easy to use; very quiet.
Negative Findings: Leisurely print speed; cost of consumables adds up over time.

RELIABILITY
COMPATIBILITY
PERFORMANCE

The DeskJet Plus' print quality was highly dependent on the paper. On the letter bond paper for which it's designed the print was excellent, outputting sharp, well-formed letters with no sign of wicking. It's another story with copier paper: print quality varied depending on the brand of paper and which side it was printed on. Once fully dried, the water-soluble ink proved resistant to smearing; only extremely black areas came out wet from the printer.

The 150-dot-per-inch draft mode used less ink than the quality print mode and printed faster as well. The results were noticeably dim but readable, and frequent use of it kept my consumption of ink cartridges ($18.75 each) down to just two in six months of light-duty work. Unfortunately, a printer reset always returned the printer setting to quality print; a DIP switch setting to make draft the default mode would be welcome.

Hewlett-Packard's font cartridges ($75 to $95) give a good selection of sizes and should be adequate for most business uses (256K RAM cartridges for soft fonts are expensive at $200 each). However, the cartridge slots use pop-off dust covers that are all too easy to lose; HP would do well to replace them with hinged doors.

Since most applications have DeskJet drivers, compatibility was not a problem. Though the DeskJet doesn't fully emulate the LaserJet, I was still able to print graphics from Lotus's LaserJet driver with no noticeable glitches.

The DeskJet Plus remains a product ideally adapted for its purpose. Though the new LaserJet IIP may cut into its market a bit (with a street price of around $650, the DeskJet is only a little less expensive than the IIP's $1,000 going rate), the DeskJet's virtues give it a good chance to hold onto its niche.

Hewlett-Packard DeskJet Plus
Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900.
List Price: $995.
CIRCLE 544 ON READER SERVICE CARD

24-PIN MONOCHROME DOT MATRIX PRINTERS

AEG Olympia NP 136-24

by Catherine D. Miller

Six months later, the bloom isn't off the rose. Extended use of the $799 AEG Olympia NP 136-24 printer has proven its ability to stand up well to the routine wear and tear of daily operation. I was particularly satisfied with its excellent paper-handling features, including an automatic tractor feed that consistently worked like a charm and a paper-parking function that made it simple to switch from standard fanfold paper to our office stationery.

AEG OLYMPIA NP 136-24

Last Review: November 14, 1989, page 246
Reason Selected: Editor's Choice
Positive Findings: Fonts with letter-quality appearance; easily understandable setup menu.
Negative Findings: Hard-to-activate membrane buttons.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Most often, I used the IBM Proprinter emulation over the Epson LQ mode and had no problems with programs such as *XyWrite, Quattro Pro, Lotus 1-2-3,* and *Sideways,* among others. The print quality remained uniformly clean throughout the test period: crisp text and good graphics were the norm.

One harmless but slightly irritating idiosyncrasy was the amount of print head positioning that takes place when you set the printer on- or off-line. It is also somewhat annoying, though not much of a problem, to activate the membrane buttons on this unit: they had to be hit from exactly the right angle to get a response. You've heard of tennis elbow; now get ready for printer finger!

The control panel is designed so that you can set defaults without cracking open a manual (indeed, I rarely needed to consult mine throughout the test period). Unlike plenty of other printers that sport obscure setup menus, this one is easy to use. Whenever I needed to—for example, when printing from DOS—I was able to simply pop in and set left, right, top and bottom margins, and page length without a fuss. It was equally easy to set slashed zero, double-height characters, and print direction from the menu.

The font and pitch buttons allowed me to change either of these print parameters without going into the setup menu at all. Experimenting with all the font selections proved to be one of the real pleasures of working with this unit: from draft to Goth-

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CIRCLE 147 ON READER SERVICE CARD

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ic to Optimo, font appearance was truly of letter quality. I guess the best testimony of what I thought of its overall quality is that I no longer went running to borrow someone else's LaserJet to send out official business correspondence: the NP 136-24 served that purpose very nicely.

AEG Olympia NP 136-24
AEG Olympia Corp., 3140 Route 22, Somerville, NJ 08876; (800) 999-6872, (201) 231-8300.
List Price: $799.

CIRCLE 545 ON READER SERVICE CARD

IBM Proprinter XL24E

by Stephen W. Plain

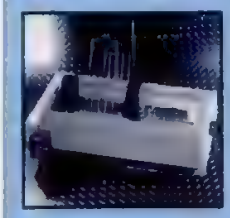
At $1,099, the IBM Proprinter XL24E is one of the more expensive dot matrix printers around, but at least you'll have the comfort of knowing you're getting your money's worth. After resisting the temptations of my laser printer so that I could put this impact beauty through its paces, I'm genuinely impressed with the quality and features of IBM's latest and greatest Proprinter.

By far, I found the most impressive design element of the XL24E to be its paper handling. The Paper Load Assist function automatically loads continuous forms slowly and accurately. This, coupled with distinct paper-hole guides, made it very difficult for me to ever go wrong loading paper. In the event of the occasional but infamous paper jam, I was able to simply snap off the pin-feed wheel guides, giving me room to remove the snagged paper easily. The Propark feature in the Proprinter made it simple to switch between continuous and cut-form paper without removing the continuous paper from the printer.

Over the long run, I appreciated the fact that I could adjust settings with a sequence on the control panel (in previous Proprinters, these were set by DIP switches). The musical Setup Mode made changing print types very quick and simple, and complete Setup directions printed right on the top of the machine meant I didn't have to waste time searching for the manual.

Another interesting feature I was glad of is the printer's ability to adjust the alignment of bidirectional print. Over time, this helps maintain a high quality of print. Ignoring the cynical grins from my colleague across the hall, I also installed the sheet-feeder option. Much to my surprise, it worked flawlessly for many months.

IBM PROPRINTER XL24E



Last Review: November 14, 1989, page 286
Reason Selected: Editor's Choice
Positive Findings: Hassle-free paper loading (the ability to adjust alignment of bidirectional print helped maintain high quality).
Negative Findings: Graphics printouts periodically marred by missed lines and doublestrikes.

RELIABILITY
COMPATIBILITY
PERFORMANCE

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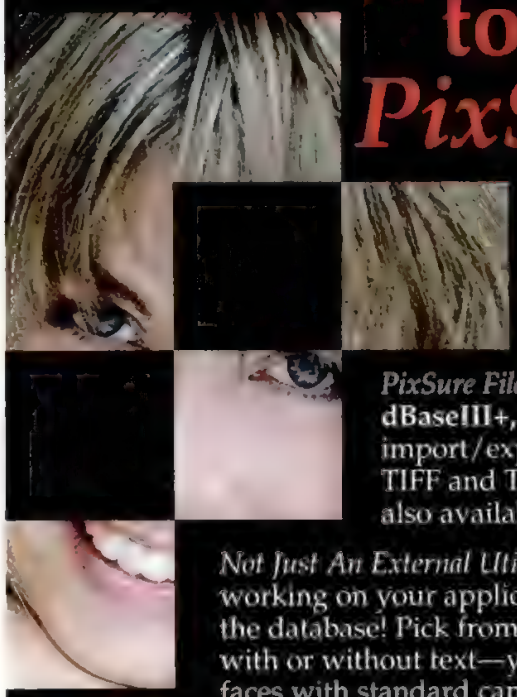

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The fine quality of the Proprinter XL24E is lacking, however, in one area: graphics. Since the 24-pin Proprinters were introduced, they've been plagued with a registration problem that causes them to miss an occasional line of the graphic and then print the following as a doublestrike. IBM says it is working on a fix but has not yet committed to a delivery date.

I was very impressed with how well my dot-matrix buddy performed for the six months I tortured it. Continuing in the Proprinter tradition, the workmanship is excellent. So if you're in the market for a quality business-level impact printer, buy the Proprinter XL24E but remember: don't look for nice graphics and do bring your VISA Gold, because IBM's graphics are disappointing and its printers don't come cheap.

IBM Proprinter XL24E
IBM Corp. (contact your local authorized IBM dealer); (800) IBM-2468 ext. 130.
List Price: $1,099.
CIRCLE 546 ON READER SERVICE CARD

NEC Pinwriter P2200XE

by Kellyn S. Betts

A reliable printer that's built to last, NEC Technologies' Pinwriter P2200XE is the sort of peripheral likely to live through numerous users in the office setting. Whether you buy this lightweight, compact $499 printer new or inherit one, you'll find it an easy-to-use companion.

I was able to begin printing almost as soon as I plugged the parallel cable into its backside. Its control panel is intuitively usable, and with the direct support of over 500 software packages, I didn't have any problems with drivers. The Pinwriter can emulate the Epson LQ printer series if all else fails, but with reduced font support. (It comes with Courier, Prestige Elite, ITC Souvenir, Helvette, and Times; 15 additional cartridge-based fonts are $50 apiece.)

As long as my Pinwriter-supporting software didn't override the printer's settings—like my constant companion *XyWrite* did but most other programs won't—I had no problem using the control panel to obtain the print mode (draft or letter quality) and spacing (10 characters per inch, 12 cpi, condensed or proportional) I wanted.

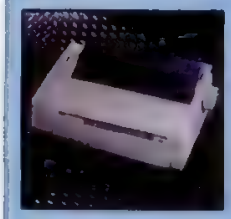
The ability of the NEC P2200XE's tractor to both push and pull paper through its path sets it apart. Unless you print on multipart forms, you'll probably want to feed your continuous forms through the printer's push tractor. This U-shaped path brought forms of less than 22-pound weight up from behind the printer and allowed me to use its paper-park feature. The ability to print on single sheets and envelopes when continuous forms were loaded was an appreciated convenience; unfortunately, feeding these items through the convenience door didn't get any easier with experience. Moreover, multipart forms require using the pull tractor, which means wasting an unprinted form in order to tear off a printed one.

The consistently fine print quality for text and graphics more than make up for minor annoyances like membrane buttons that require real pressure to be successfully activated. Although I experienced some inexplicable variations in darkness produced by one ribbon cartridge, others proved quite capable of printing the 400,000 to 2 million characters that NEC estimates the Pinwriter delivers on average. If you're using the printer to produce the great-looking graphics for which it is known, these ribbons can go pretty quickly, but they last a reasonable amount of time when printing letters, memos, and the like.

The NEC Pinwriter P2200XE is not the perfect printer for a heavy user of multipart forms. But these past few months have proven to me that anyone else would do well to consider it.

NEC Pinwriter P2200XE
NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; (508) 264-8000.
List Price: $499.
CIRCLE 547 ON READER SERVICE CARD

NEC PINWRITER P2200XE



Last Review: November 14, 1989, page 298
Reason Selected: Editor's Choice
Positive Findings: Consistently fine print quality, intuitive control panel
Negative Findings: Feeding envelopes and single sheets when continuous-form paper was loaded didn't get easier with experience.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Panasonic KX-P1124

by Sharon Terdeman

It didn't take six months for me to fall in love with the Panasonic KX-P1124 dot matrix printer. Right from the start, the narrow-carriage system proved itself worthy of its Editor's Choice and Technical Excellence for 1989 awards. Output from this very reasonably priced ($499.95) printer was always good and often excellent.

The unit not only gets high marks for print quality (I noticed no degradation over these months) and speed, but it also comes up a winner on flexibility and ease of use. The latter two features are particularly important in a machine designed for personal or small businesses that don't have resident printer experts right down the hall. For instance, I was able to load paper from the rear, front, or bottom using either single sheets, continuous paper, or multipart forms. And I found the five internal fonts to be more than adequate; even its script font was surprisingly legible.

At first glance, I didn't expect the KX-P1124 to be easy to use. Although there are no DIP switches to fumble with, the so-called EZ Set front panel sports enough membrane switches and LEDs to intimidate novices. However, it didn't take much experimentation to make feature selection via the panel a minor task. Often, you can simply rely on default mode, which lets your software determine font

PANASONIC KX-P1124

Last Review: November 14, 1989, page 302
Reason Selected: Editor's Choice
Positive Findings: Flexibility of loading paper from the rear, front, or bottom; very legible fonts (including script).
Negative Findings: Manual needs revamping.

RELIABILITY
COMPATIBILITY
PERFORMANCE

and pitch: just load the driver for your application, and you'll never even have to touch the KX-P1124.

But the *true* test of a printer is its agility when it comes to handling envelopes. Here again, the KX-P1124 is a winner. The most difficult part of the whole procedure was finding the information in the manual, which is unfortunately arranged in order by a description of the panel button functions rather than by the procedure you are trying to perform. Once I located the necessary information, printing an envelope was a breeze. All I had to do was park the paper, switch over to friction feed, and insert the envelope. My very first was a beauty!

The Panasonic KX-P1124 won a place in my affections for many reasons; not the least of which were its short learning curve and admirable output. This printer has become something more than just another piece of my electronic office—it's become a habit.

Panasonic KX-P1124
Panasonic Communications & Systems Co., Office Automation Group, 2 Panasonic Way, Secaucus, NJ 07094; (800) PIC-8086.
List Price: $499.95.
CIRCLE 548 ON READER SERVICE CARD

Unisys AP 1324

by Joe F. Rizzo

Whether attached to my standalone PC or hooked up to a file server, the Editor's Choice–winning Unisys AP 1324 withstood the many hassles that come with handling high-volume loads. A wide-carriage dot matrix, it performed not only reliably but also rather quietly.

One of my biggest fears in using dot matrix printers with tracker-feed mechanisms—particularly on a network—is their almost human ability to know the most inopportune moment to cause a paper jam. I am happy to say that I never needed to readjust, realign, unjam or for that matter even touch the paper, except to load it and remove printouts. An asset like that in a dot matrix machine is of major value for anyone who plans to use it on a file server or for long print jobs.

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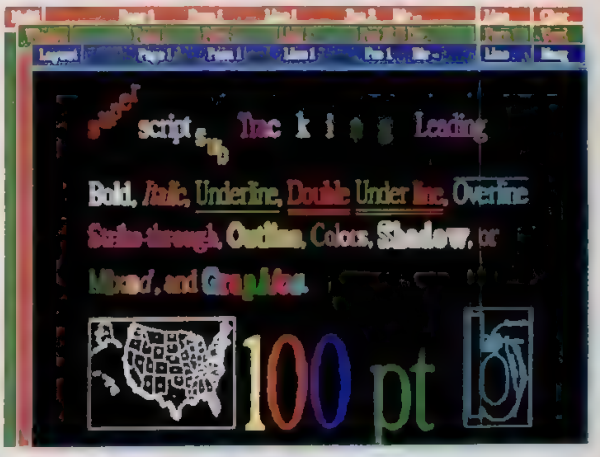

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CIRCLE 149 ON READER SERVICE CARD

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internal workings produced by Epson; its $1,850 price tag is actually a few hundred dollars higher than its identical counterpart, the Epson LQ-2550. (Interestingly, the LQ-2550 missed getting Editor's Choice by a hair's breadth in our printer blockbuster: it was reviewed with its color option, and its capabilities in this area were less remarkable than the competition's.) Not surprisingly, the printer comes with an Epson LQ-2550, as well as a Diablo 630, emulation. The Epson emulation includes eight fonts: draft, Roman, Courier, Prestige, Script, OCR-A, OCR-B, and sans serif.

UNISYS AP 1324

Last Review: November 14, 1989, page 319
Reason Selected: Editor's Choice
Positive Findings: No paper jams—important for a printer meant to handle high-volume work for a single user or a network.
Negative Findings: Its internal workings are the same as those of the Epson LQ-2550, but its price is higher.

RELIABILITY
COMPATIBILITY
PERFORMANCE

In the six months I used it, I had the opportunity to test it with a variety of software packages, from word processors to *Windows* applications. No problems there. Nor did anyone else who had access to it report any problems.

Despite the amount of hard copy it was asked to generate, print quality remained consistent, without any tendencies to smudge or smear. Text always looked very good, and the graphics output was excellent. The print remains as dark as ever, although I did take out and reinstall the ribbon just to see if the process would be painful (it was hassle-free).

If you're at all sensitive about your eardrums, you'll appreciate the fact that the printing chamber is surrounded by foam padding to absorb sound. The quietness may seem a minor point, but if you're using a dot matrix for high-volume output on a daily basis, you'll really appreciate the noise relief.

Unisys AP 1324
Unisys Corp., P.O. Box 500, Blue Bell, PA 19424; (215) 986-3501.
List Price: $1,850.

CIRCLE 549 ON READER SERVICE CARD

COLOR DOT MATRIX PRINTERS

C. Itoh C-610

by Bill O'Brien

A color-capable dot matrix machine, C-TECH's $799 C. Itoh C-610 survived the endurance test with good scores, revealing only a minor quirk throughout the trial.

The system's journey from PC Labs, where it had undergone the rigors of our 1989 printer blockbuster benchmark tests, landed it at my doorstep on somewhat shaky legs. The internal rattling sound greeting my ears as I pulled it out of

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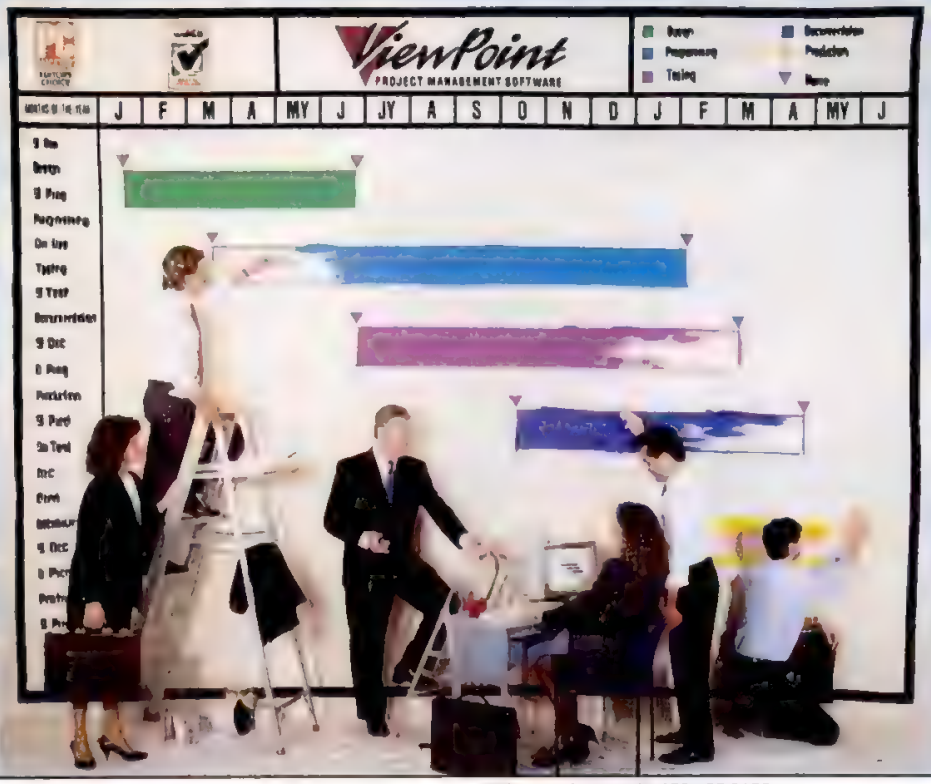

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CIRCLE 169 ON READER SERVICE CARD

the box gave me the perfect excuse for taking the unit apart. Luckily, the C-610 is easy to disassemble, and a quick breakdown to its bare essentials revealed an orphan screw floating around its insides. The origin of the misplaced hardware was somewhere in its past, perhaps when a faulty ribbon-recognition switch plagued the reviewer who had undertaken the initial evaluation for the blockbuster.

Paper handling with the C-610 ran smoothly. I was able to use both rear-fed tractor forms and single cut sheets through its forward-mounted tray. It dealt well with the complexities of multiple-part forms and automatic top-of-form loading. The simple act of loading a ribbon, however, sheared off a small plastic retainer clip

C. ITOH C-610

Last Review: November 14 1989, page 358
Reason Selected: Editor's Choice
Positive Findings: No gaps in graphics images or degradation in overall print quality
Negative Findings: During the process of loading a ribbon cartridge a plastic clip essential to holding it in place sheared off

RELIABILITY
COMPATIBILITY
PERFORMANCE

essential to holding the cartridge in place. While the actual ribbon installation was accomplished in under 10 seconds even though I was using a four-part color ribbon (the bane of many color printers), it took an additional minute or two to find and apply the masking tape now needed to hold the cartridge in place.

With the exception of the ribbon mishap, the C-610 has worked flawlessly. I expected no less considering that the C. Itoh 8510 I purchased many years ago is still up and running despite some initial problems. In the last few months I've thrown text documents from *Word*, spreadsheets from *Excel*, and color files from *Designer* at the C-610, watching it gobble them up and then spit out just what I'd asked for. As is the case with all dot matrix printers, the graphics did suffer somewhat from banding, but there were no gaps from an inaccurate stepper motor or

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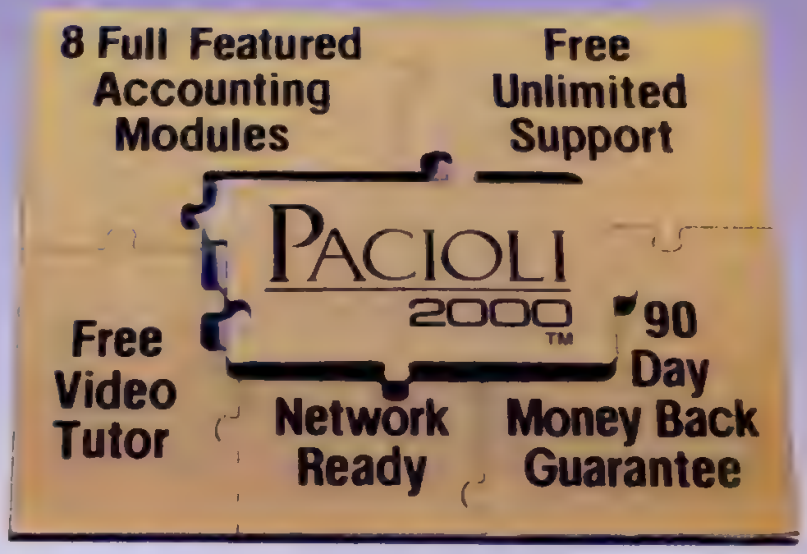

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CIRCLE 196 ON READER SERVICE CARD

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Because microLaser features the PostScript language, you can print fonts in a variety of type styles and sizes. Plus, you can print them tall-ways, long-ways, all kinds of ways. You can even print complex pages of integrated text and graphics.

Capabilities that grow as your needs grow.

One of the best things about microLaser is that you only buy what you need. So if you're not ready for PostScript language, you can buy the standard microLaser for less than $2,000 and add PostScript software and other powerful features later.

You can upgrade microLaser without tools or technicians by simply adding upgrade boards. These boards include up to four 1Mb increments of memory, serial and AppleTalk® interfaces and a PostScript interpreter. All you have to do to get additional fonts or emulations is plug optional microCartridges into two credit card-size slots.

Superior paper handling.

Part of what makes microLaser a truly personal desktop laser printer that takes up so little room is its paper drawer, which slides *inside*. Because microLaser holds *250 sheets* standard (it holds 500 when you add an optional paper drawer), you spend less time refilling paper and more time creating superb-looking documents.

The printer also handles a variety of paper sizes and types – from letter, legal and executive to transparencies, labels and envelopes. For those times when you're facing a large mail merge task, just plug in an optional envelope feeder to easily alternate between letters and envelopes.

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CIRCLE 353 ON READER SERVICE CARD

Standard microLaser is HP LaserJet II-compatible, prints six pages per minute and comes with .5 Mb of RAM. microLaser PS has the same features as the standard microLaser, plus an Adobe PostScript interpreter with 35 typefaces and an extra 1 Mb of RAM.

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misinterpreted emulation commands.

Print quality didn't decline, either. This was a pleasant surprise, as the last color dot matrix I used (from another company) showed noticeable degradation in its color output with the passing of time.

With Epson LQ-2500 and IBM Proprinter emulations, font cartridges that make it competitive to laser output, and color (not as exquisite as a QMS ColorScript but far less expensive), the C. Itoh C-610 stands out as a long-term winner.

C. Itoh C-610
C-TECH Electronics Inc., 2515 McCabe Way, P.O. Box 25138, Irvine, CA 92714; (800) 347-4017.
List Price: $799.

CIRCLE 550 ON READER SERVICE CARD

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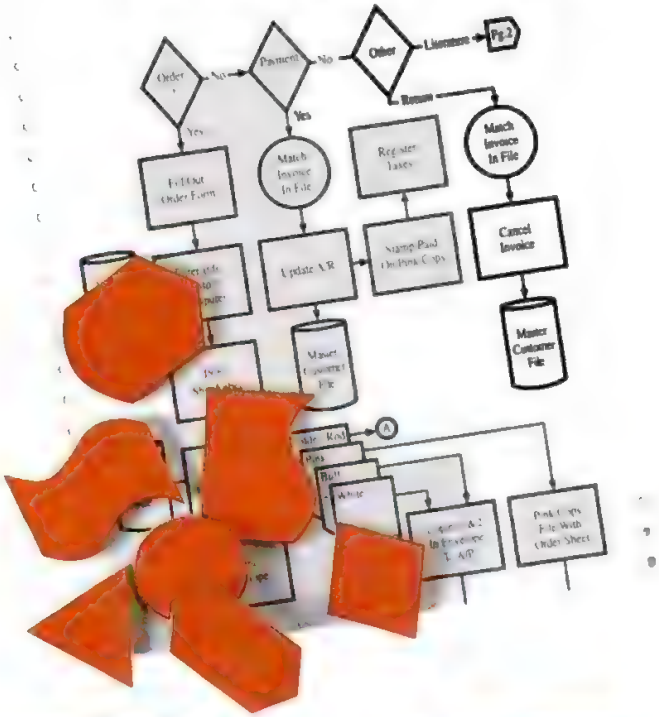

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CIRCLE 301 ON READER SERVICE CARD

Star Micronics XB-2415 Multi-Font

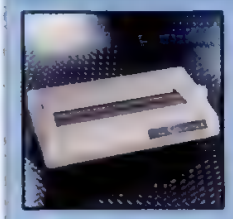
by Robin Raskin

While taking on the Star Micronics XB-2415 dot matrix printer meant packing up my LaserJet for six months, a full range of features (including glorious *color*) went a long way towards compensating me for my loss. While I can't say that using this $1,049 wide-carriage printer has turned me into a dot matrix convert, the experience was more pleasurable than I would have thought.

Printouts made with the four-color ribbon were unblemished by smudges or smears. While not on a par with smooth Hewlett-Packard PaintJet output, the 360-dot-per-inch graphics consistently looked good.

But installing the optional color kit—a polygonal plastic box that sits below the ribbon cartridge—revealed a serious problem. In the process, I inadvertently dislodged one of the two ribbon-advance gears. Suddenly my printer was outputting legible hard copy only when the print head was moving backwards. Star's technical support diagnosed the situation immediately; the company also assured me that new models have a protective covering over the printer gear mechanism to avoid this problem.

STAR MICRONICS XB-2415 MULTI-FONT



Last Review. November 14, 1989, page 374
Reason Selected: Editor's Choice
Positive Findings: Envelopes printed easily, even though there's no special envelope facility; excellent fonts.
Negative Findings: Problem during installation of color kit (fixed in new models).

RELIABILITY
COMPATIBILITY
PERFORMANCE

One of the best things about this system is its fonts: 14 of them, and not a slouch in the bunch. Times Roman and TW-Light are available in a double pass (48 by 35 character matrix), Super LQ mode. Others, including Prestige, Script, Cinema, and Blippo (LQ with 24 by 35) added pizazz aplenty to my documents.

Thanks to a well-designed front panel, I

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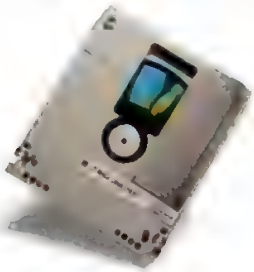

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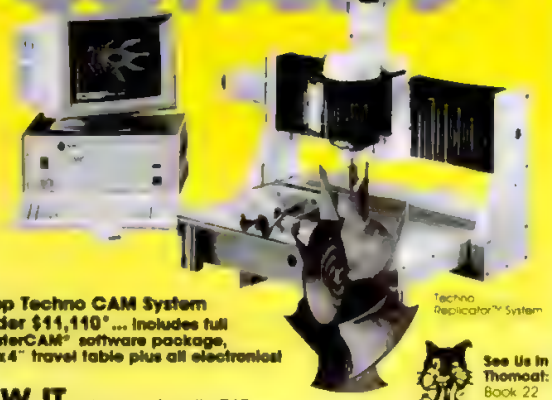

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MAKE IT On the Techno Replicator™ using a variety of materials ranging from machineable wax, wood and plastic to non-ferrous metals

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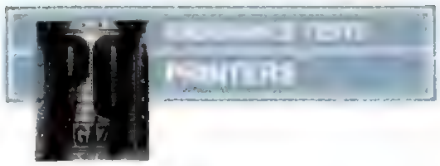
CIRCLE 134 FOR IMMEDIATE APPLICATION
CIRCLE 143 FOR FUTURE REFERENCE



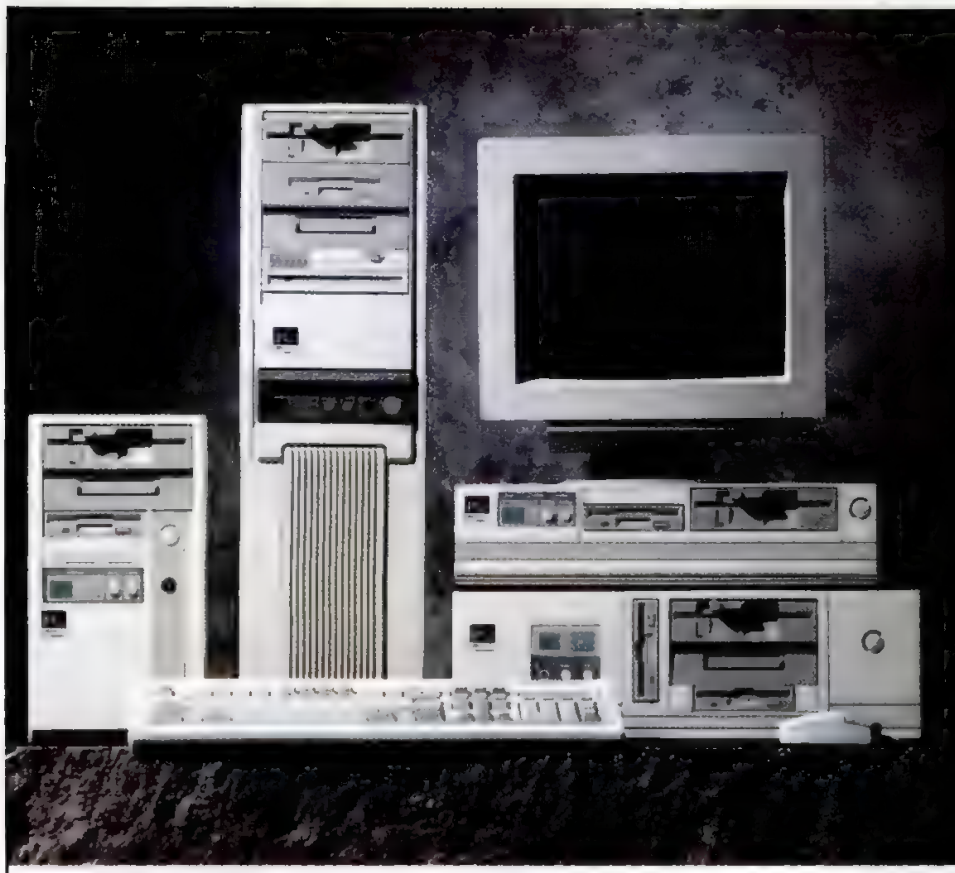
did about 99 percent of my font and attribute selections without ever worrying about software or DIP switches. I experimented with a variety of paper options—fanfold, letterhead, form-feed, postcards, multipart forms, and even envelopes (though there's no special envelope facility)—and never encountered a single jam. The paper-parking mechanism—which let me switch between continuous and cut sheet paper—never failed, although it lacks the rugged feel of systems like the IBM Proprinter.

The XB-2415 was not directly supported by some of my applications (like *1-2-3*, *Harvard Graphics*, and *Excel*), but color and font options worked when I selected any Epson LQ or Star NB series. I was also able to emulate the IBM Proprinter via a DIP switch setting (easily accessible from the front, something to be thankful for over the long term). *Microsoft Word*, *WordStar*, and *Word Perfect* 5.1 drove the XB-2415 directly.

When we last reviewed the XB-2415 printer, Star Micronics promised that some add-ons would be forthcoming. A 32K RAM card and a 128K parallel buffer have appeared, but the additional font cartridges are not yet ready. When they arrive, they'll be the icing for this already delectable cake. ■

Star Micronics XB-2415 Multi-Font
Star Micronics America Inc., 70D Ethel Rd. West, Piscataway, NJ 08854; (201) 572-9512.
List Price: $999 ($50 extra for color kit).

CIRCLE 601 ON READER SERVICE CARD



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-Personal Computing's 10 Best Mail Order Companies, Feb. 1989

286 SYSTEMS FROM $599

PC BRAND 286/12 _____ $599

12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 Landmark ™ Speed 15.1MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

PC BRAND 286/16 _____ $749

16 MHz Clock, Zero Wait Operation,
Norton SI 19.0 Landmark ™Speed 20.6MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

PC BRAND 286/20 _____ $899

20 MHz Clock, Zero Wait Operation,
Norton SI 23.0 Landmark™ Speed 26.7MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

Standard System Features:*

- 80286-12, 80286-16, 80286-20 operating at 12 MHz, 16MHz, or 20MH z w/Zero Wait
- 512K RAM expandable to 8MB on the System board using 256K or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1 Interleaved Hard/Floppy Drive Controller, 1Mb/Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 Serial & 1 Parallel ports on std-configurations
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS w/full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM 4.0EMS hardware
- User configurable I/O timing permitting compatible operation w/older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim Line Case w/3 Disk bays (as pictured above)
- Mini Size desk top Tower* Case w/4 bays
- VGA or CGA Plasma Portable Case
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice

PC BRAND 286/12

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	66/25	100/25
No Video	$929	$1029	$1209	$1349
Mono	$1049	$1149	$1329	$1469
VGA-Mono	$1229	$1329	$1509	$1649
VGA-Color	$1459	$1559	$1739	$1879
SVGA/Color	$1569	$1669	$1849	$1989

PC BRAND 286/16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	66/25	100/25
No Video	$1079	$1179	$1359	$1499
Mono	$1199	$1299	$1479	$1619
VGA-Mono	$1379	$1479	$1659	$1799
VGA-Color	$1609	$1709	$1889	$2029
SVGA/Color	$1719	$1819	$1999	$2139

PC BRAND 286/20

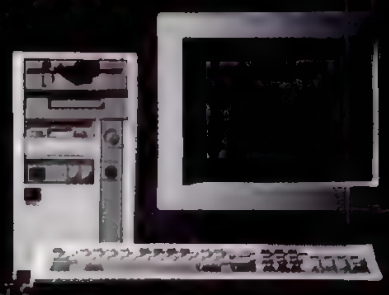
w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	66/25	100/25
No Video	$1229	$1329	$1509	$1649
Mono	$1349	$1449	$1629	$1769
VGA-Mono	$1529	$1629	$1809	$1949
VGA-Color	$1759	$1859	$2039	$2179
SVGA/Color	$1869	$1969	$2149	$2289

CIRCLE 303 ON READER SERVICE CARD

*Tower is a registered trademark of NCR Corporation

*Features below for 286/16 and 20 only. Call for 286/12



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Best "Executive Decision" System.

-Personal Computing, Best Bargain Systems, Dec. 1989

"The PC Brand 386/SX-16 performed at least as well as the far costlier Compaq... We simply began marveling at what is surely the biggest bargain in personal computing."

-Computer Buyer's Guide, Cover Story, Oct. 1989

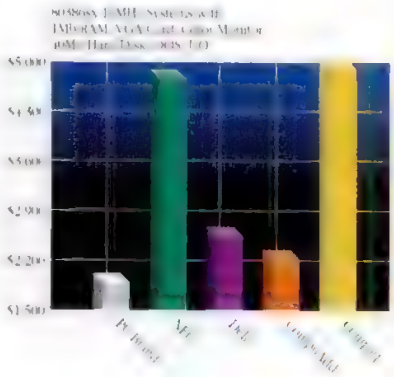
Intel 386 Technology at 286 Prices the 386SX-16 Only $899

PC BRAND 386/SX-16____$899

16 MHz Clock, Zero Wait Operation • Norton SI 18.7 Landmark™ 18.3MHz 512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

Standard System Features:

- 80386SX Processor Operating at 16MHz delivering 18MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1 Interleaved Hard/Floppy Drive controllers. 1 Mb/Second disk transfer rates on all 100 Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 Serial & 1Parallel ports on std-configurations
- High Capacity 200 Watt System Power Supply
- Real Time Clock Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/ 6 Disk Drive bays (Shown in optional Mini Size Tower * Case)



PC BRAND 386SX-16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	66/25	100/25
No Video	$1229	$1329	$1509	$1649
Mono	$1349	$1449	$1629	$1769
VGA-Mono	$1529	$1629	$1809	$1949
VGA-Color	$1759	$1859	$2039	$2179
SVGA/Color	$1869	$1969	$2149	$2289

Options:

- Low profile Slim Line Case w/3 Disk bays
- Mini Size desk top Tower * Case w/4 Disk Drive bays (as pictured above)
- VGA or CGA Plasma Portable Case
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice

CIRCLE 308 ON READER SERVICE CARD

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*TRW-National Computer Maintenance Services

"The Best Low-Cost Alternative Around!"

-PC Magazine, 25MHz 386 PC's, Feb. 14, 1989

PC BRAND'S 386/20 386/25...

"FASTER THAN A SPEEDING BULLET!"

-Computer Shopper, Cover Story November, 1988

20MHz FROM $1349

25MHz FROM $1499

PC BRAND 386/20 _____ $1349

20 MHz Clock, Zero Wait Operation,
Norton SI 23.0 Landmark Speed26.1MHz,
1024K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

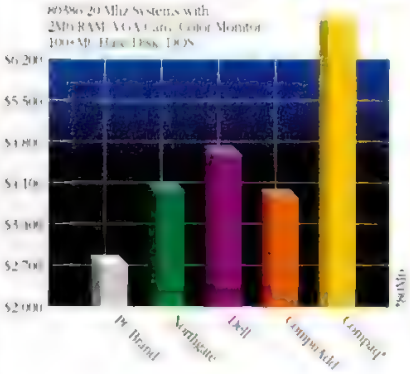
PC BRAND 386/25 ____ $1499

25 MHz Clock, Zero Wait Operation,
Norton SI 28.2-Landmark Speed 33.6MHz,
Norton SI 31.6-Landmark Speed 43.5 w/Cache,
1024K RAM,1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

"The PC Brand 386/25 is a fascinating machine. It offers flexible configuration...at a bargain price..."

"and the company backs it all with what may be the longest warranty on the market...PC Brand makes it possible to buy two complete sytems for less than most competitors charge for just one."

- PC Magazine, 25MHz 386 PC's February 14, 1989



Standard System Features:

- True 20MHz or 25MHzZ Intel 80386 CPU Operating with Zero Wait States
- 1024K RAM standard expandable to 16MB using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1 Interleaving Hard Drive/Floppy Drive controllers, 1Mb/Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 serial & 1 parallel ports on std-configurations
- High Capacity 200Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387, or Weitek Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim-Line Case w/3 Disk bays
- Full Size Tower ® Case w/8 Disk Drive bays
- Mini Size Tower ® Case w/4 Disk Drive bays
- VGA or CGA Plasma Portable Case
- Custom configurations w/Name Brand peripherals of your choice

(Shown in Medium foot print Desktop Case)

PC BRAND 386/20

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	66/25	100/25	200/19
No Video	$1779	$1959	$2099	$2549
Mono	$1899	$2079	$2219	$2669
VGA-Mono	$2079	$2259	$2399	$2849
VGA-Color	$2309	$2489	$2629	$3079
SVGA/Color	$2419	$2599	$2739	$3189

PC BRAND 386/25

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	66/25	100/25	200/19
No Video	$1929	$2109	$2249	$2699
Mono	$2049	$2229	$2369	$2819
VGA-Mono	$2229	$2409	$2549	$2999
VGA-Color	$2459	$2639	$2779	$3229
SVGA/Color	$2569	$2749	$2889	$3339

CIRCLE 309 ON READER SERVICE CARD

386/33 CACHE _____ $2299

33 MHz Clock, Zero Wait Operation, Norton SI 45.9 • Landmark 58.7 MHz, 1024K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

"Here's a price $2799... [Now $2299] Must be stripped to nothing, Right? Wrong...You don't sacrifice quality for low price either. The PC Brand machines are an efficient combination of in-house engineering and top-notch off-the-shelf Parts."

-PC Magazine, 33MHz 386 PC's, October 31, 1989

"...great value. *Period*. ...excellent price performance ratio; high quality."

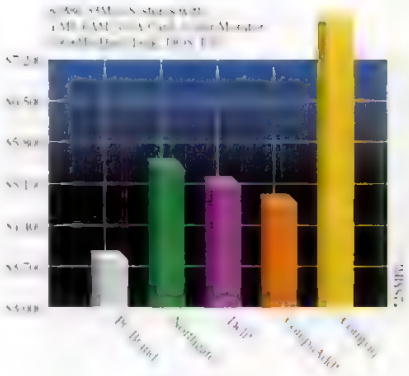
-Computer Buyers Guide, Product Review, February, 1990

Standard System Features:

- True 33 MHz INTEL 80386-33 CPU operating w/Zero Wait States Delivering up to 58.7 MHz Effective Throughput
- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard
- 1024K RAM Standard Expandable to 16MB
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Hard Drive/Floppy Drive Controllers, 1 Mb/Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- I/O Ports-2 serial,1 parallel
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS with Full MS DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- EMS and Disk Cache in ROM
- 8 Slot motherboard design
- Medium foot print case w/6 Disk Drive bays

Options:

- Full size Tower * Case w/8 Disk Drive bays (as pictured above)
- Custom configurations w/Name Brand peripherals of your choice
- Factory Installed Ram Upgrades



PC BRAND 386/33 CACHE

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	66/25	100/25	200/19
No Video	$2779	$2859	$2999	$3619
Mono	$2789	$2979	$3119	$3609
VGA Mono	$2979	$3159	$3299	$3749
VGA-Color	$3289	$3380	$3529	$3979
SVGA/Color	$3419	$3499	$3639	$4089

Turn the page for Portables & Peripherals

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CIRCLE 304 ON READER SERVICE CARD

The Industry's Most Flexible Casing Options

How many times did you wish that your computer were just a little smaller. How about space for another disk or tape drive? Or just one more I/O slot to add that scanner board, fax card or modem?
And remember that time when you needed just another few hours in the day to get that project done and couldn't take your system home or to a Client's?

PC Brand recognizes that many users have unique needs. The standard desktop machine is always a compromise that does't fit everyone.
To us, our Client's needs always come first, so we offer the largest, most flexible series of enclosure alternatives available in the industry today.

Slim Line

Neat, compact, attractive and versatile; our Slimline desktop case offers the ideal solution for the Executive's desk where both footprint and appearance are important, or the Entry station where space is at a premium. Available in configurations ranging from entry level Diskless 286/12 workstations up through top of the line performing 386's with over 200Mb of disk storage, this unit sacrifices little to achieve its goals of clean design and small size.

Desk Top

Unlike the conventional 'Clone' cases found in the market, our Standard full sized desk top case is the first of an entirely new generation. This case fully integrates the lessons learned in the last 5 years of PC history. Full 8 slot I/O, 6 Drive bays and a 200 Watt PS/2 style compact Power Supply result in maximum configurability across our full line of system/drive and video applications, where a desk top placement is desired.

Mini Tower*

Where your application requires more drives or I/O slot configurability than offered with our Slim Line case, but small footprint, attractive design and desk top placement are still required, our Mini Tower* Case is the solution.

Server/Multi-User Tower*

Our Server/Multi-User Tower* case has been designed for Local Area Network and other Multi Terminal applications which typically call for massive Disk storage, maximum I/O card slot usage, high total system power consumption and enhanced operational security. It's larger size, cable routing facilities, enhanced power supply, extra cooling and push button security features have all been optimized around the needs of these systems.

Rack Mount & Custom Cases

Rack mount and other custom enclosures can be configured to your specifications by our special bid desk.

CIRCLE 310 ON READER SERVICE CARD

*Tower is a registered trademark of NCR corporation

Server/Multi-User Tower*

Physical Specifications

Dimensions:
7.5"W x 25.5"H x 17.9"D

Construction: 1.4mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 47.3 Lbs

Functional Specifications

I/O Slots: 8 total featuring:
8 full length 16-bit or 8-bit

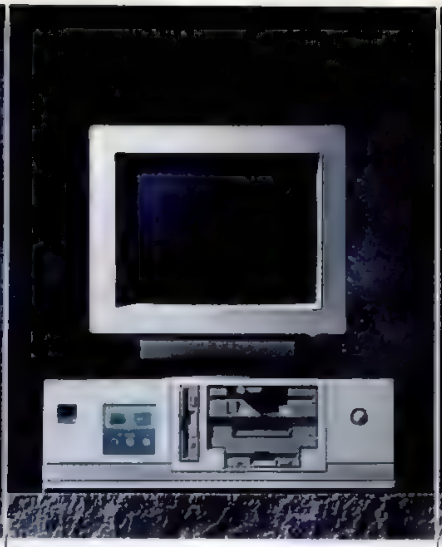
Drive Support: 6 total disk or tape drives mounted as follows:
4 Exposed 5.25" 1/2 Height
2 Internal 5.25" 1/2 Height
(all bays can be used for 3.5" drives also.)

System Power: 220 Watt U/L Heavy Duty

Indicators: Turbo Speed Numeric Indicator, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button, Keyboard Key Lock

Special Push button cover to protect against accidental activation of either turbo or reset buttons.



Slim Line

Physical Specifications

Dimensions: 17.1"W x 4.25"H x 16.8"D

Construction: 1.2mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 26.5 Lbs

Functional Specifications

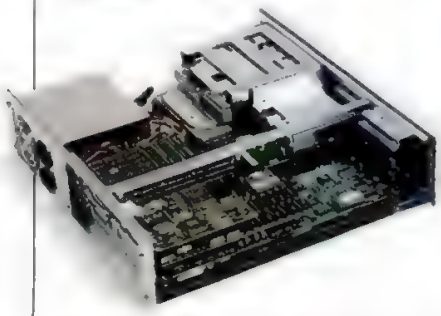
I/O Slots: 5 total mounted on 90 degree rotated adapter tree inserted into main system board 16-bit slot featuring.
2 full length 16-bit
1 half length 16-bit
2 half length 8-bit

Drive Support: 3 total disk or tape drives mounted as follows
1 Exposed 5.25" 1/2 Height
1 Internal 5.25" 1/2 Height
1 Exposed 3.5" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed LED, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button



Desk Top

Physical Specifications

Dimensions: 18.9"W x 6.5"H x 15.9"D

Construction: 1.4mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 40.5 Lbs

Functional Specifications

I/O Slots: 8 total featuring
8 full length 16-bit or 8-bit

Drive Support: 6 total disk or tape drives mounted as follows
2 Exposed 5.25" 1/2 Height
2 Exposed 3.5" 1/2 Height
2 Internal 5.25" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed LED, Hard Disk Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button, Keyboard Key Lock

Mini Tower

Physical Specifications

Dimensions: 7"W x 12.9"H x 15.9"D

Construction: 1.2mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 25.6 Lbs

Functional Specifications

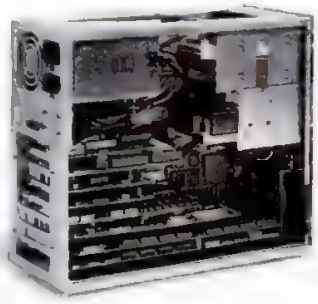
I/O Slots: 7 total featuring
7 full length 16-bit or 8-bit 1 half length 16-bit or 8-bit

Drive Support: 4 total disk or tape drives mounted as follows
2 Exposed 5.25" 1/2 Height
2 Exposed 3.5" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed Numeric Indicator, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button System, Reset Push Button, Keyboard Key Lock



All photographs above feature PC Brand 386 Series motherboards configured with maximum options to demonstrate the capabilities of each specific case

Certain I/O, drive, and power cables have been removed to improve visibility of components

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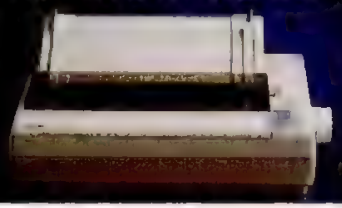

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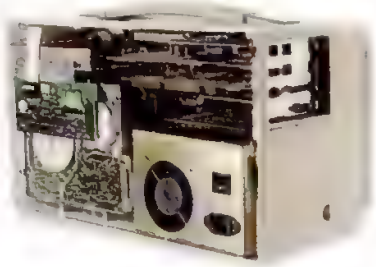

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Dimensions: 16.2"W x 9.75"H x 8.25"D
Construction: High Impact ABS Moulded Plastic
Weight: 25 Lbs (Configured) 17 Lbs (Empty)

Functional Specifications

I/O Slots: 2 total unused in typical factory configuration featuring: 1 full length 16 or 8 bit, 1 half length 8 bit
Drive Support: 3 total disk or tape drives mounted as follows:
2 Exposed 5.25", 1.2 Ht. 1 Exposed 3.5"
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Display: High Resolution Gas Plasma display with over 10,000 hour operating life. Nonglare screen with over 120 degrees of viewing angle

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16 Grey scales
12:1 Contrast Ratio
Adjustable Brightness
Screen Size: 7.75" x 5.75", 10" diagonal

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Uses 'screen shift' keys to emulate Hercules resolution on 640 x 400 Internal display
4 Grey scales
Auto screen shut off when idle
Screen Size: 8.25" x 5.75", 10" diagonal

VGA Gas Plasma Portables

Drives	[illegible]	[illegible]	[illegible]	[illegible]
286/12	[illegible]	[illegible]	[illegible]	[illegible]
286/20	[illegible]	[illegible]	[illegible]	[illegible]
386/SX/16	[illegible]	[illegible]	[illegible]	[illegible]
386/20	[illegible]	[illegible]	[illegible]	[illegible]
386/25	[illegible]	[illegible]	[illegible]	[illegible]
386/25*	[illegible]	[illegible]	[illegible]	[illegible]
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*32K Cached versions

CGA/MGA Gas Plasma Portables

Drives	[illegible]	[illegible]	[illegible]	[illegible]
286/12	[illegible]	[illegible]	[illegible]	[illegible]
286/20	[illegible]	[illegible]	[illegible]	[illegible]
386/SX/16	[illegible]	[illegible]	[illegible]	[illegible]
386/20	[illegible]	[illegible]	[illegible]	[illegible]
386/25	[illegible]	[illegible]	[illegible]	[illegible]
386/25*	[illegible]	[illegible]	[illegible]	[illegible]
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M · O · S · E · M

REMOTE CONTROL

S O F T W A R E

The Next Best Thing to Being There

by Mike Byrd

Whether you want to use the files from your office PC at home or provide technical support to a user in another location, remote computing packages can give you access and control.

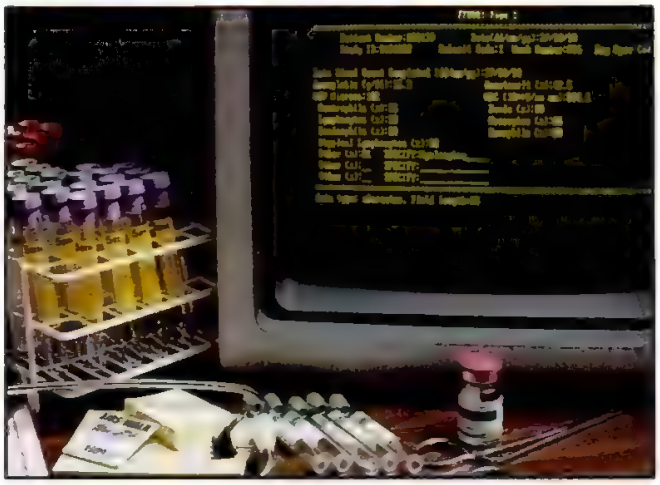
No matter how many files you manage to fit onto the hard disk of a portable, time and again you'll still need a file that resides on your office PC. Having a remote-control program installed can be a great relief when you're far away from the office. Remote computing packages for the PC have been lifesavers for several years, and the latest batch offer some powerful capabilities, including enhanced EGA and VGA graphics, the ability to record a session and play it back later, and multitasking.

Remote computing uses software, modems, and the phone lines to connect two PCs and make them behave like one machine, even when separated by great distances. The computer whose files and programs are accessed is called the *host*, and the one that takes control of the host's operations is the *remote*. While you sit at the remote, it's as if you were also at the host, its keyboard and screen becoming an extension of your own. If another user is actually at the host site, you might feel like a flight instructor giving lessons to students in a

plane equipped with dual controls. You can see everything the student does, while the student can observe your maneuvers and learn from watching.

File sharing is one of the most common functions for a remote computing program, but many imaginative applications are possible. You can work simultaneously with someone on a spreadsheet, database, accounting, or word processing program. If you're a tech support person, you can monitor, control, and troubleshoot software without traveling to a customer's site. From home you can connect to the office computer and access a database or run an application package. You can transfer updated files to other PCs or connect to a LAN.

Initially we considered ten software packages for this review. At first we didn't think that so many existed. A preliminary review revealed that three of the packages did not permit PC remote computing as we define it: using a host computer from another location as if you were actually there viewing its screen and typing at its keyboard. *APE (A Programmable Emulator)*, from HI-Q International, is a powerful terminal emulator that allows you to pass information between the PC and a variety of mainframe environments. However, it does not let you mirror a PC's screen and keyboard from a remote site. *HyperAccess/5*, from Hilgraeve, and *XChange Plus*, from Commtech International, are sophisticated information-sharing programs that can perform unattended file transfers but not keyboard and screen sharing. Another area not reported here includes shareware comm packages such as *Qmodem* and *Telix* that can be operated in a host mode from which you can shell to DOS.



Researchers at Memorial Sloan-Kettering Cancer Center in New York use *BLAST RemoteControl* to track trends in the spread of AIDS in the U.S. via PCs in hospitals nationwide.

After installing all seven remote computing packages, we found many features in common, even when their implementations and approaches differed. For example, each one normally has its own proprietary compression scheme, though *Takeover* gives you a choice between *PKPAK* and one of your own. Installation was relatively easy. Each package gave a list of modems to select from, and once the selection was made, installation was automatic. None of the programs that we reviewed is copy protected, but in the majority of cases a program will not connect to another copy that has the same serial number.

In our previous reviews of remote-control programs, the speeds of file transfers and text and graphics screen updates were crucial issues, and these are still measured in our benchmark tests. Fortunately, the painfully long screen refreshes that programs suffered from several years ago have improved remarkably, and all those we examined this time can operate at 9,600 bits per second. Moreover, all of the programs keep logs of screen sessions—an important issue for customer support people. Thus, remote computing programs provide increasingly great convenience for the user who needs to be away from the office PC but does not want the files that are stored on it to be out of reach.

EDITOR'S CHOICE

- **Remote²**
- **Takeover**

The remote-control packages reviewed here have nearly identical features and similar functions. *Takeover*, the new kid on the block, is essentially *Co/Session* with a better user interface, more flexibility, and a relatively low RAM requirement. *Takeover* has a wide variety of features and offers a fresh approach to remote computing.

The latest release of *Remote²* rates well in its ease of use and in its ability to work with its across-the-LAN sibling, *R2LAN*.

Remember that all the remote-control programs work well; your intended application should dictate the package you buy. *Close-Up* and *Co/Session* are geared toward applications that involve customer support, while *BLAST Remote-Control* and *Takeover* are built around file-transfer programs. The other programs we reviewed are most likely to be used by those who wish to access their own files from a remote site.

BLAST RemoteControl

BLAST, a communications program from Communications Research Group (CRG), is best known for its fast file transfers—which rely on its Blocked Asynchronous Transmission (BLAST) protocol. Now *BLAST RemoteControl* ($295) offers all the features of the old program plus new remote communications capabilities: *Control* and *Satellite*. *Control* allows users to take screen and keyboard control of other PCs. *Satellite* accepts calls and lets other computers—PCs, Macs, minis, or mainframes—take control.

Satellite is a memory-resident function that requires 90K RAM and runs in the background. When *Satellite* detects an incoming call, it "answers" the connection and prompts for a log-on ID and password. Once the caller has activated *Control*, *Satellite* allows transparent access to DOS. A keystroke can initiate file transfers in the background, while the *Satellite* application continues to run, undisturbed, in the foreground.

Since you don't want just anybody to access your files, *BLAST RemoteControl* offers multilevel password protection to limit access to authorized users. The menu-driven security administrator program is also password protected; it encrypts password and log-in ID records to insure their

FACT FILE

***BLASTRemoteControl*, Version 9.0**
Communications Research Group, 5615 Corporate Blvd., Baton Rouge, LA 70808; (800) 24 BLAST, (504) 923-0888.
List Price: *BLAST RemoteControl* (*Control* and *Satellite*), $295; *Satellite* 1.0 only, $149.
Requires: 156K RAM, DOS 3.0 or later. For *Satellite*: 90K RAM (118K for graphics).
In Short: *BLAST RemoteControl* offers a powerful file-transfer capability among PCs, Macs, and minis, plus remote control of a PC. Remote video operations are synchronized to the host computer and consequently seem slow.

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privacy. For even further security, you can install a *BLAST Private Network*, which features hard-coded "locks" and "keys" to allow file transfers only between registered copies of the program.

BLAST RemoteControl comes with three disks and installs with relative ease, although I did have to edit the script file before it would work on my Hayes-compatible modem. In operation, the program's newness to the remote computing field is apparent. It uses pop-up menus but not always in an intuitive way, so it is slightly more complex to operate than its competitors. Compared with them, screen scrolling at the remote site seems slow, and it slows down operations on the host. CRG representatives tell us that a forthcoming version will resolve some of these difficulties.

On the other hand, *BLAST RemoteControl* offers a powerful remote unattended mode. It can automatically poll connected computers running *Satellite* and transfer files while programs at the remote sites continue undisturbed.

BLAST RemoteControl's excellent technical support is available by phone, fax, Telex, and BBS. The program's strong point is its file-transfer functions, which work alongside its newly added remote-control capability.

Carbon Copy Plus

When many users think of remote-control software, *Carbon Copy Plus*, by Microcom Software Division, comes first to mind. It was one of the original remote-control programs for the PC and remains one of the most popular. At $199 per copy, it offers menu-driven commands that are

SUMMARY OF FEATURES: REMOTE-CONTROL PROGRAMS

Products listed in alphabetical order

All of the remote-control programs we reviewed include certain basic features. All of them can transfer files between a host and a remote computer, in either direction, and the output can be printed at either location. Each package offers data compression, an internal telephone directory, a chat mode, and automatic logging of each call.

Some of the other features may require explanation.

Unattended file transfers Most programs allow you to schedule a file transfer for a specified time. The transfer is then made in background mode.

Session recording and playback means that all screen activity can be recorded to a file for subsequent replay. This can be handy when you want to assist a customer in debugging a problem on his or her computer.

Error checking monitors incoming data; if noise is encountered, the data packet is automatically retransmitted. This prevents noise from creating garbage characters on-screen.

Printer output can be ignored Opting to ignore printer output means that the print stream will be directed to a null device. This will allow programs that require a printer to run even when no printer is connected.

Unsynchronized video mode Normally the host and remote screens are synchronized, which means that the remote screen is refreshed every time a change is made on the host PC's screen. Some systems allow you to set the default—synchronized or unsynchronized. If an unsynchronized mode is selected, the remote screen is updated periodically, usually when the host CPU is not busy. Because there are fewer transmissions across the modem line, running in unsynchronized mode is faster.

Terminal emulation A given package may offer—for instance—TTY, VT100, IBM, or multiple emulations.

Disables host This feature enables the remote user to blank the host's screen and disable its keyboard, preventing access by another user.

A **call-back feature** works this way: When the remote PC calls in and supplies an ID and password, the host disconnects and returns the call. Because it uses a stored telephone number linked with the given ID, the host effectively confirms the caller's location.

A **voice/data switch** makes it possible to change from voice to data transmission or vice versa without disconnecting and reconnecting.

	BLAST RemoteControl	Carbon Copy Plus	Close-Up	Co/Session	pcAnywhere III	Remote²	Takeover
List price (host plus remote)	$295	$398	$440	$249	$145	$195	$295
Unattended file transfers	■	■	■	■	❑	❑	■
Session recording and playback	❑	■	■	■	■	■	■
Error checking	■	■	■	■	■	■	■
Printer output can be ignored	■	❑	■	■	■	■	■
Printer output can be spooled	❑	■	❑	■	■	■	❑
Graphics support:							
VGA	❑	■	❑	■	■	■	■
EGA	❑	■	❑	■	■	■	■
HGC	❑	■	❑	■	■	❑	■
CGA	■	■	■	■	■	■	■
MCGA	■	■	❑	■	■	■	■
Nonsynchronized video mode	■	■	■	■	❑	■	■
Terminal emulation	Multiple	Multiple	TTY	TTY	TTY	TTY	TTY
Security features:							
Checks password	■	■	■	■	■	■	■
Disables host	■	■	■	■	■	■	■
Reboots on disconnect	■	■	■	■	■	■	■
Restricts file/directory access	❑	■	■	■	■	■	■
Call-back feature	❑	■	■	■	■	■	■
Voice/data switch	❑	■	■	■	■	■	❑

— Editor's Choice Yes — ■ No — ❑

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easy to use when you want to act as a "guest" user of a host PC in a remote location. You can control, monitor, and test software running on the host PC, or transfer files between the two PCs.

Carbon Copy Plus also provides many terminal-emulation capabilities that let you use your PC as if it were a terminal connected to a host computer. Thus, you can access information databases and transmit or receive telexes from around the world. Since *Carbon Copy Plus* also supports the popular Xmodem, Xmodem Batch, Ymodem, Ymodem Batch, and Kermit file-transfer protocols, you can exchange files with a wide variety of host computers.

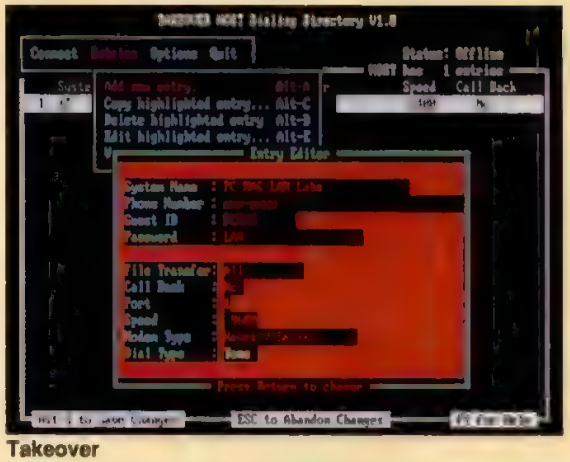
File transfers in the remote-control part of the program use a proprietary, error-correcting data compression protocol. This allows the host user to continue working or leave the computer unattended while a file transfer takes place. A utility allows you to save screen images and session activity in a disk file and then replay that information later. The two sides do not need to have the same graphics cards installed. EGA, VGA monochrome, Hercules, and CGA are all fully supported and fully interchangeable at both ends of the link.

Installing the program from its two floppy disks is a trivial matter; you need just a little knowledge of your system to set the comm port, modem type, and phone numbers of the modems involved. You type CC to start the RAM-resident (55K) program, and it is ready to receive. A hotkey combination calls up a screen menu that allows you to call any phone number in the directory or input a number manually when you want to call out. The same hotkey permits you to monitor and change procedures such as screen capture, file compression, and printer redirection during an ongoing session. *Carbon Copy Plus* is bidirectional; it can be used on the host or the remote computer.

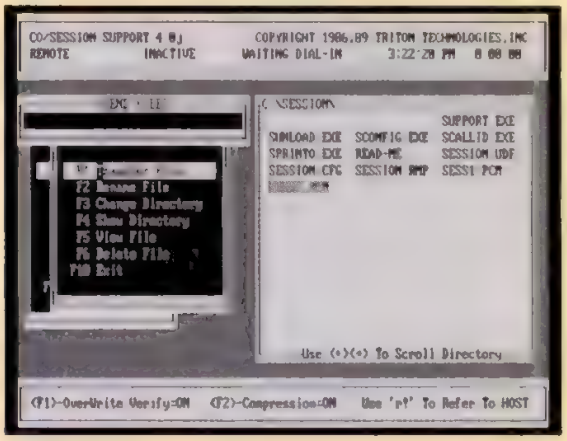
Microcom provides tech support by phone if you have trouble with the program. But it's so easy to install and use, you won't need much training before you can monitor and use a remote computer. *Carbon Copy Plus* is a dependable choice.

What's on the Menus for the Host and the Remote

Many of the remote-control programs have menu-driven interfaces that make them very easy to configure. *Takeover*'s *Host* dialing directory lets you easily add a new entry, like the one shown here for PC LAN Labs. *Co/Session*'s *Support* program lets you transfer a file from the directory displayed on the screen. Also note that *Co/Session* gives you the option of turning compression on or off. Some types of graphics files cannot be compressed, and turning compression off allows you to transfer these files with less difficulty. ■



Takeover



Co/Session

Close-Up

Multitasking enters the remote computing field with *Close-Up*, an integrated communications system from Norton-Lambert Corp. Two separate packages make up the *Close-Up* system, *Close-Up Customer/Terminal* and *Close-Up Support/ACS* ($195 and $245, respectively). Between them, they provide remote, background-terminal, and automated-communications capabilities for the PC.

Customer/Terminal contains two integrated programs in one. The *Customer* side handles the host computer communications and runs in the background, using 67.7K RAM. The *Terminal* side lets you communicate with time-share, information utility, electronic mail, and bulletin board services. *Terminal* can send or receive information and even print what is received (e-mail, for example) while you work with an application program.

The *Support/ACS* program likewise comprises two integrated programs. The *Support* side handles the remote operations, acting as a terminal or "window" looking at the *Customer* screen. *ACS* stands for Automated Communications System, and the *ACS* side is designed to automate everything you would do by hand. This includes sending and fetching files, or entering keystrokes to a remote computer, as well as running an application program

FACT FILE

***Carbon Copy Plus*, Version 5.2**
Microcom Software Division, 55 Federal Rd., Danbury, CT 06810; (617) 551-1999.
List Price: $199 per copy (two required).
Requires: 256K RAM, DOS 2.0 or later.
In Short: *Carbon Copy Plus* remains an easy-to-use remote-control program with strong supporting utilities. It supports VGA, EGA, and CGA graphics on both sides of the connection at the same time.

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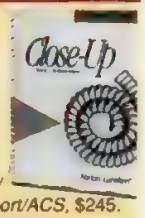
concurrently with *Support/ACS*.

Close-Up's unique feature is the multitasking ability of its *Support* (remote) program. With *Support* you can be connected to a *Close-Up* customer and run an application program concurrently on the remote machine. *Close-Up* also provides multiple passwords, specific command lines set up for different remote users, and call-back numbers that allow the host to disconnect and call back the remote before allowing access to the host files.

Installation of *Close-Up* is the easiest among all of these programs. You copy only one file for each of the two packages. These occupy minimal space on the hard or floppy disk, but they don't skimp on power. Both packages are easy to use, requiring only that you call up a menu for simple instructions. Many program parameters can be changed on the fly, such as printer redirection and screen capture. Technical support is available by phone.

The worst glitch showed up in our graphics performance tests. The EGA screen updates were incomplete, and the VGA screen write wouldn't work. In our tests, CGA didn't work, either, but it did function when we ran text-based applications. But the *Close-Up* system generally offers a robust remote communications capability. It's easy to use and gives you several bonus communications features.

FACT FILE



***Close-Up*, Version 3.0A**
Norton-Lambert Corp., P.O. Box 4085, Santa Barbara, CA 93140; (805) 964-6767.
List price: *Close-Up Customer/Terminal*, $195; *Close-Up Support/ACS*, $245.
Requires: 44K to 66K RAM, DOS 2.0 or later.
In Short: A modem, menu-driven, point-and-shoot remote communications program that offers user-friendliness as well as extra communications capabilities and multitasking. *Close-Up* sells as two separate packages, allowing you to configure your PCs as needed.

CIRCLE **626** ON READER SERVICE CARD

Co/Session

Like *Carbon Copy Plus*, *Co/Session* doesn't give you just plain remote video displays, it lets you see enhanced Hercules, EGA, and VGA graphics at a remote site. Programs on the order of *Microsoft Windows*, *Microsoft Excel*, and *AutoCAD* can run in *Co/Session*'s high-level graphic modes, and the higher graphics levels are supported without any additional memory requirements.

Triton Technologies' full *Co/Session* package for two PCs costs $249. This includes two versions of the software, which you can also purchase separately: a $125 *Application* version that works only in the host mode, and a $135 *Support* version that allows host and remote operation. Both versions are RAM-resident, the *Application* version using 51K to 95K (depending on whether you want to transfer graphics screens) while the *Support* version requires 123K.

Operations such as file transfers, keystrokes, and screen data are error-checked with *Co/Session*'s sliding window protocol, a full-duplex protocol similar to SDLC and X.25 that allows data to be sent and received simultaneously. Screen data and keystrokes can be error-checked even further for operation on noisy phone lines or for additional security. *Co/Session* offers several levels of security, including call-back, data encryption, passwords, directory access, keyboard disabling, screen blanking, dial-in notification, and file-transfer security.

Regardless of all the security options, *Co/Session* is easy to install; all you do is copy the files off a floppy disk. A hotkey calls up concise, easy-to-follow point-and-shoot menus. The only time we had to refer to the manual was for file transfers, since you're required to designate the location of the remote (R!) and host (H!) before the drive, path, and filename. While not bothersome, this procedure just wasn't obvious. Once I became familiar with the conventions, file transfers were brisk. If you need technical support, it's available by phone.

Co/Session provides another user-friendly remote-control package, and its price is definitely competitive.

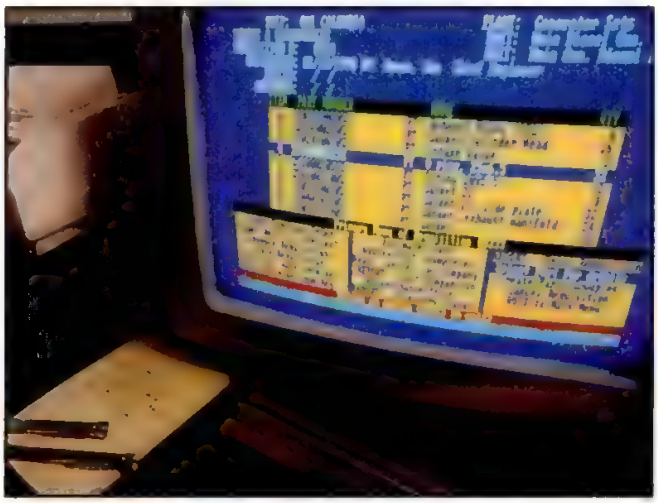
FACT FILE

***Co/Session*, Version 4.0**
Triton Technologies Inc., 200 Middlesex Turnpike, Iselin, NJ 08830; (800) 322-9440, (201) 855-9440.
List Price: *Co/Session Application*, $125; *Co/Session Support*, $135; both packages, $249.
Requires: 51K RAM on host (95K with graphics), 123K on remote; DOS 2.0 or later.
In Short: *Co/Session* is an easy-to-use remote communications package offering simple installation, point-and-shoot menus, and high-level graphic modes. The program is worthwhile in terms of both speed and price.

CIRCLE **627** ON READER SERVICE CARD

pcAnywhere III

pcAnywhere III, from Dynamic Microprocessor Associates, offers a wide range of compatibility with other hardware platforms. It lets you run any PC remotely from any other PC, terminal, or Macintosh. Priced at $145 per copy, it lets you control all programs, data, attached peripherals, and internal cards, just as if you were sitting in front of the distant PC.



O.M.I. Corp.'s supertanker operators use *BLAST* software to requisition supplies by tapping into the mainland computer. When the ship arrives at port, the supplies are at the dock.

pcAnywhere comes with two disks, a *pcAnywhere* disk and an *ATERM* disk. *ATERM* is a simple dumb-terminal program. When you run it on a PC, you can control the host PC keystroke for keystroke. If your remote computer is not IBM compatible *ATERM* lets you emulate PC-specific keys with Esc-key codes.

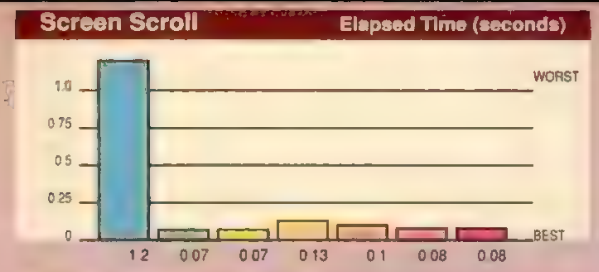
PERFORMANCE TESTS: REMOTE-CONTROL PROGRAMS

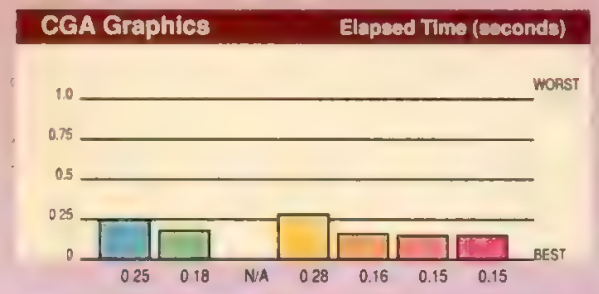
Both *Takeover* and *Co/Session* led the pack in remote-control software performance. Each was adept at transferring files quickly and at moving different types of graphics images between PCs.

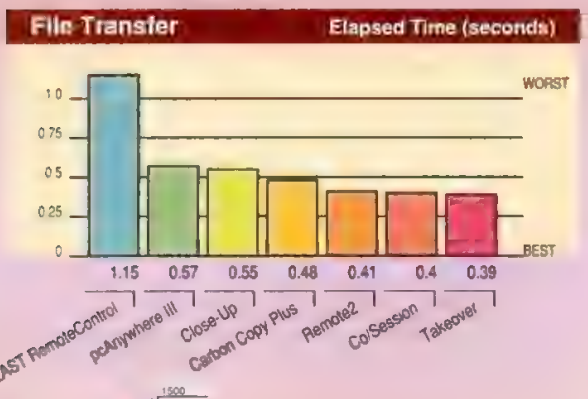
The **File Transfer** test times how long it takes the host to send the remote PC a 50K data file that resists data compression algorithms. In each case, we use the product's default file-transfer protocol.

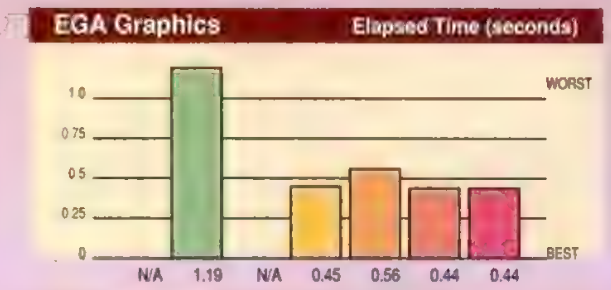
The **Screen Scroll** test times how long it takes to scroll a 50K ASCII text file from the screen of the host to the screen of the remote PC using unsynchronized screen mode—the fastest screen update method.

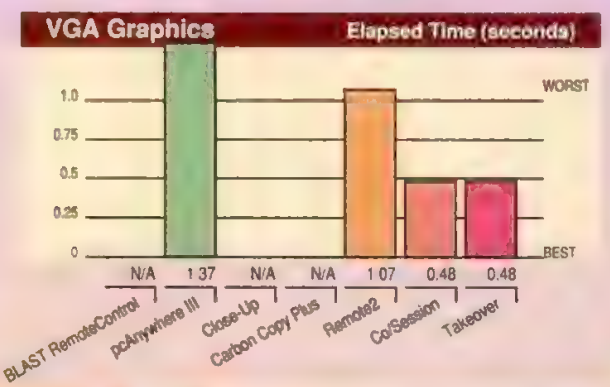
The Graphics tests use an image created in *PC Paintbrush,* Version 3.0—originally 576 pixels wide and 720 pixels high, with 16 colors. This is transferred from the host to the remote PC in different screen modes. The **CGA Graphics** test uses 640- by 200-pixel resolution in 2 colors, the **EGA Graphics** test uses 640 by 350 resolution in 16 colors, and the **VGA Graphics** test uses 640 by 480 resolution in 16 colors.

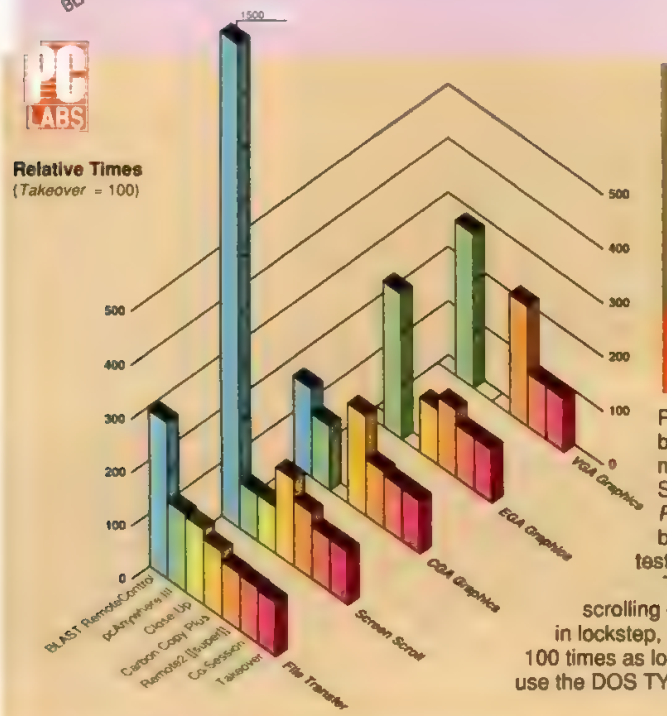












COMPOSITE VIEW: REMOTE-CONTROL PROGRAMS

PC Labs tested the software packages by moving files and screens between an ALR PowerCache 486/33 and a Dell System 325. The machines were connected over dial-up telephone lines using Hayes Smartmodem 9600s operating at 9.6 kilobits per second. *Carbon Copy Plus* could not complete the VGA Graphics test in the color VGA mode but succeeded with the Monochrome VGA Graphics screen update (a test score not reported here).

The Screen Scroll test reports times for unsynchronized screen scrolling only. Thus, although the screens on the host and remote PCs are not in lockstep, they finish with the same image. Synchronized scrolling takes 50 to 100 times as long but may be useful in some applications (for instance, if you want to use the DOS TYPE command to display a file and then pause during the output).

N/A—Not applicable: this product could not complete the test.

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"But the amount of data is no concern with

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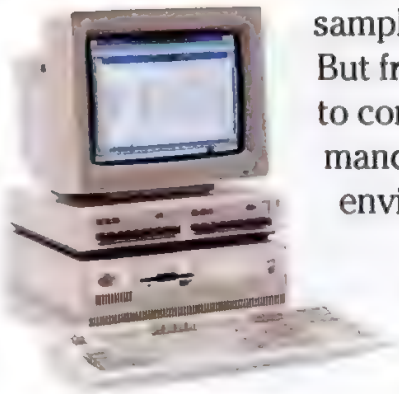

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FACT FILE

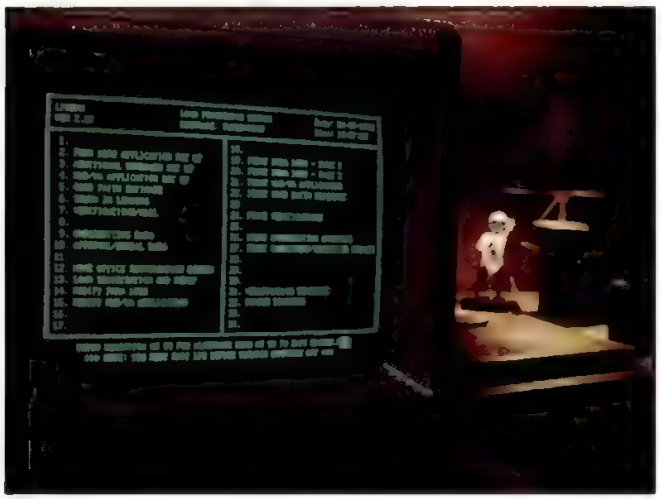
***pcAnywhere III*, Version 3.11A**
Dynamic Microprocessor Associates, 1776 E. Jericho Turnpike, Huntington, NY 11743; (516) 462-0440.
List Price: $145.
Requires: 48K RAM on host, 256K on remote; DOS 2.0 or later.
In Short: *pcAnywhere III* is a small remote-control package that uses little RAM and offers clear operations via pop-up menus. This is one to keep in mind.

CIRCLE **628** ON READER SERVICE CARD

pcAnywhere is the heart of the host system. It can be RAM-resident (using 48K) or can execute in the foreground. A hotkey calls up the menu any time, even in the middle of an application. Since error detection can have an effect on speed, the pop-up menu gives you three error-checking options: slow, fast, and none. If you're using high-speed modems with error-checking protocols built-in, the ability to turn error checking off can save time. According to the manual, fast error-checking is appropriate for most conditions, while slow error-checking is the most reliable, although it slows down screen updates.

To install *pcAnywhere*, copy the program files onto a hard disk using the DOS COPY command. Typing "anywhere" starts the program. Immediately a screen pops up showing default values for baud rate, comm port, and modem type. If these are okay, you are in operation, and you can return to DOS with *pcAnywhere* in the background or just stay in the resident mode. The remote computer operator has to log in with an I.D. and password, and subsequently is treated as part of the host computer. If you have any difficulty, technical support is obtainable by phone.

pcAnywhere is yet another low-cost, easy-to-use remote-control PC package. A big plus is the low amount of RAM space it uses. Applications with large memory requirements might run with *pcAnywhere* although they would not work with other remote-control programs. And one copy of *pcAnywhere III* provides the software necessary for both sides of a PC-to-PC connection, both host and remote.



Loan officers in the New Jersey firm of Margaretton & Co. use *BLAST RemoteControl* to hook up with the company computer to keep track of interest rates for mortgage approvals.

Remote²

Remote², by Digital Communications Associates (DCA), offers a direct, simple path to remote communications. You get complete control of the host computer, allowing remote operation of PC applications from another PC or terminal. Both host and remote keyboards are live, so users at either end can control the host.

Remote² consists of two units, *R2Host* and *R2Call*. They can be purchased as a single package for $195, or separately for $129 and $89, respectively.

R2Call is a dedicated communications program used for calling *Remote²* hosts. Together with the *R2Host* program, it provides exact mapping on the host keyboard; fast file transfers you can perform anytime or on a fixed schedule; remote printer redirection; CGA, EGA, and VGA color graphics; and an error-checked link that uses data compression even with conventional modems. If the host PC is attached to a LAN, you can also remotely access the LAN's resources.

Both *R2Host* and *R2Call* install easily. Simple questions prompt you through the process. Operation, too, is quite simple, though if you have trouble, technical support is a phone call away.

The programs use an integrated phone book that lists phone numbers, names, passwords, and settings for up to 2,000 host systems. Once the phone book entries are made, dialing and log-in are automatic between the host and remote computers. While it waits for calls, *R2Host* runs in the background, using 61.6K RAM. It can answer calls even while an application is running on the host machine, and you can choose to have it answer all calls or require an operator keystroke before answering.

FACT FILE
EDITOR'S CHOICE

***Remote²*, Version 2.0A**
Digital Communications Associates, 1000 Alderman Dr., Alpharetta, GA 30201; (800) 241-IRMA, (404) 442-4930.
List Price: *R2Host*, $129; *R2Call*, $89; both, $195.
Requires: 61K RAM on host, 128K on remote; DOS 2.0 or later.
In Short: *Remote²* is a basic remote-control package offering elementary installation with point-and-shoot menus. It's a fast performer for the budget-minded.

CIRCLE **629** ON READER SERVICE CARD

Both *R2Host* and *R2Call* can initiate connections with a single keystroke. A hotkey pops up a menu for file transfers, local operations, printer control, and termination of the session.

Security features include unique user IDs and passwords, different startup commands for each user, host screen and keyboard disabling, restricted access to selected directories, and a call-back feature.

The *Remote²* system is an easy-to-use, uncomplicated approach to remote PC control. It offers the best kind of speed and simplicity, and the price isn't bad either.

Takeover

Takeover is a recent collaboration between two data communications companies: SoftKlone Distributing Corp., the publisher of *Mirror*, and Triton Technologies, the maker of *CO/Session*. SoftKlone took Triton's remote-control drivers and

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Developers. Artisoft offers a Voice Programmer's Interface so you can create your own "talking" software using the LANtastic Voice Adapter. Order it directly from Artisoft.

See us at
COMDEX/Spring '90
June 3–6, 1990
Atlanta, Georgia

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THE COMPUTER PRINTER

NX-1000 II *NX-1000 Rainbow* *LaserPrinter 8 II* *XR-1000* *NX-2410* *XB-2410*

designed them around the *Mirror* communications package. The result is a $295 PC remote-control program offering speed as well as communications flexibility.

Takeover consists of two parts, one for each PC. The *Host* program controls the host PC, while the *Guest* program controls the remote computer. The latter program consists of *Mirror III*, an add-in interface module, terminal emulation, and a driver package. Both programs may be controlled with a mouse, but the host application program can not use the mouse.

Takeover's file-transfer utility uses an error-correcting data compression protocol that provides error-free transmissions. Security features include passwords, a call-back feature, limited file transfers, permitted directories, and host screen and keyboard disabling.

Guest and *Host* install easily through a series of questions. The *Host* program uses pull-down menus to configure its guest directory, operating parameters such as modem type and speed, and other options. The *Host* menus also direct the host computer's actions, telling it, for example, to begin waiting for a call-in or to exit from *Host* as a RAM-resident (68K) program.

FACT FILE
EDITOR'S CHOICE

***Takeover*, Version 1.0**
SoftKlone Distributing Corp., 327 Office Plaza Dr., #100, Tallahassee, FL 32301; (800) 634-8670, (904) 878-8564.
List Price: $295.
Requires: Hard disk; 55K to 70K on host, 480K on remote; DOS 2.0 or later.
In Short: *Takeover* is a clone of two communications programs providing the advantages of both. This is a strong, fast package, complete with intuitive pop-up menus.

CIRCLE 630 ON READER SERVICE CARD

You can control *Guest* either using the dialing directory interface with its pull-down menus or using the command-driven status screen interface. Each guest maintains a list of host sites that it can access. Guest computer users can also write scripts for unattended operations that cause *Guest* to go through a predefined series of steps, without requiring the users to be there to control it.

Operation of the system is straightforward, but if you need help, you can contact tech support by phone or bulletin board. The pop-up menus work intuitively and lead you directly to the function you require. File transfers and screen updates are fast, which is not surprising since *Takeover* uses the same remote drivers as *CO/Session*.

Takeover is a friendly program offering a powerful unattended control capability. One copy gives both remote and host capacities to two PCs. This combined communications and remote-control package offers users speed and simplicity. ■

Mike Byrd, a U.S. Air Force fighter pilot, holds master's degrees in engineering and computer science and is a division chief in a branch of the federal government that develops sophisticated electronics systems.

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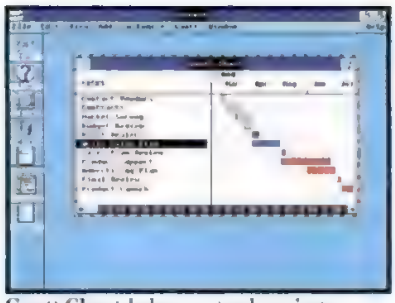
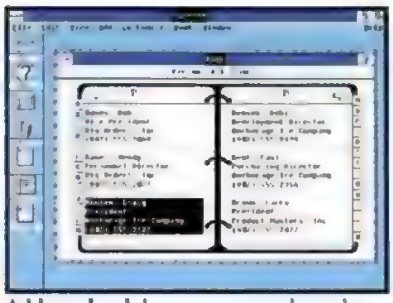
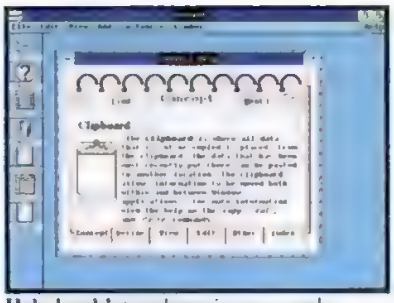
PROJECT BOARD



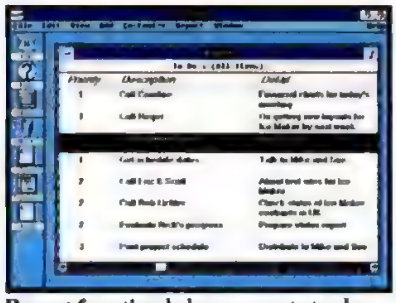
Gantt Chart helps you track projects, manage time.



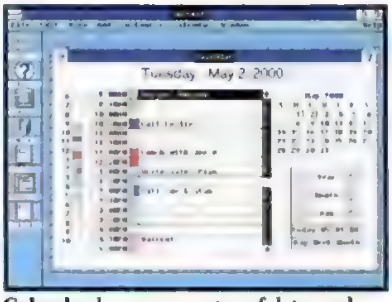
Address book keeps names and numbers at your fingertips.



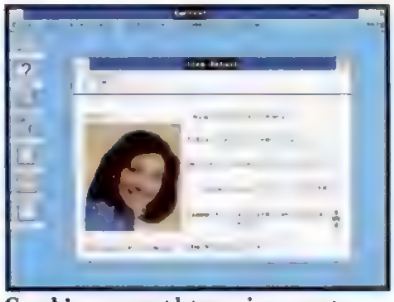
Help booklet is always in your reach.



Report function helps you create to-do lists and print professional-looking reports.



Calendar keeps you on top of dates and appointments, lets you view any day, week or month at a glance.



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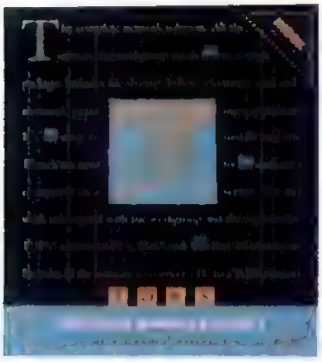

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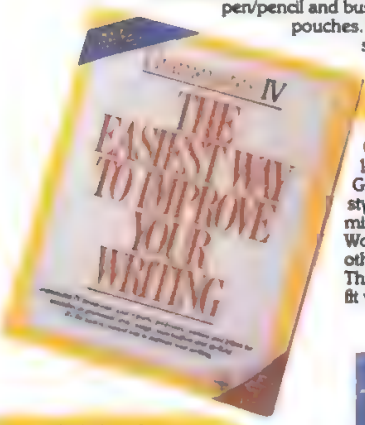

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Sideways 3.21 ..... 37.
Gibson Research
Spinrite II ..... 69.
hDC Computer Corp.
Windows Express ..... 39.
Helix
Headroom 2.0 ..... 69.
Hilgraeve
Hyperaccess/5 1.0 ..... 109.
Intuit
Quicken 3.0 ..... 35.
Lord Publishing
Ronstadt's Financials ..... 99.
Lotus
Agenda 1.01 ..... 259.
Lotus 1-2-3 Rel. 2.2 ..... 339.
Lotus 1-2-3 Rel. 3 ..... 399.
Lotus 1-2-3 Upgrade Kit ..... 124.
Magellan ..... 109.
Symphony 2.2 ..... New.
Meca
Managing Your Money 6.0 ..... 118.
Metro Software
Lasertwin All In One ..... 112.
Microcom
Carbon Copy Plus 5.1 ..... 105.
R:Base for DOS 2.1 ..... 456.
Relay Gold 4.0 ..... 165.
Microrim
R:Base Compiler ..... 579.
Microsoft
Excel 2.1 ..... 295.
Windows 3.0 ..... New.
Word 5.0 ..... 205.
Word for Windows ..... 310.
Works 2.0 ..... 92.
Multisoft
PC-Kwik Powerpak 1.5 ..... 72.
Super PC-Kwik 3.3 ..... 49.
Nantucket Corp
Clipper 5.0 ..... 492.
Nolo Press
Willmaker 3.0 ..... 34.
Paul Mace
Grasp 3.5 ..... 110.
Peachtree Software
Peachtree Complete III ..... 147.
Peachtree Cmpl. III Bonus Bdle ..... 212.
Peter Norton Computing
Norton Util. Advanced 4.5 ..... 80.
Norton Commander 3.0 ..... 85.
The Norton Backup 1.0 ..... 84.
Power Up Software
Calendar Creator Plus ..... 39.
Top Priority ..... 58.
Precision Software
Superbase 4 Windows ..... 429.
Prime Solutions
Disk Technician Advanced 6.0 ..... 89.
Disk Technician Professional ..... 36.
Primetime Software
Primetime Personal ..... 68.
QMS
Ultrascript PC ..... 119.
Ultrascript PC Plus 2.0 ..... 265.
Qualitas
386Max Professional ..... 75.
Quarterdeck Office Sys.
Desqview 2.25 ..... 69.
Desqview 386 ..... 118.
Expanded Memory Mgr. 5.0 ..... 55.
QEMM 386 5.0 ..... 55.
QRAM w/Manifest ..... 45.
Reality Technologies
Wealthbuilder (by Money Mag.) ..... 135.
Reference Software
Grammatik IV 1.0 ..... 49.
Rightsoft
Rightwriter 3.1 ..... 49.
Rinearson Support Assoc.
Microsoft Word Companion Disk ..... 29.
Samna
Ami Professional ..... 305.
Softlogic Solutions
Software Carousel ..... 55.
Software Publishing
PFS: First Choice 3.02 ..... 105.
Professional File 2.01 ..... 189.
Professional Write 2.1 ..... 139.
Spinnaker
BetterWorking Eight-In-One ..... 35.
The Resume Kit ..... 29.
Symantec
Grandview 1.0 ..... 196.
Q & A 3.0 ..... 219.
TimeLine 4.0 ..... 459.

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Timeslips Corp.
Timeslips III 3.4 ..... 161.
Tops
Flashcard ..... 148.
Tops Network Bundle for DOS ..... 286.
Traveling Software
Laplink III ..... 85.
Unison World
Avagio ..... 169.
West Lake Data
Westlake Value Pak ..... 64.
WordPerfect Corp.
PlanPerfect 5.0 ..... 269.
WordPerfect 5.1 ..... 249.
WordPerfect Library 2.0 ..... 69.
WordStar U.S.A.
WordStar 6.0 ..... 256.
XTree Company
XTree Pro Gold ..... 72.
XYQuest
XYWrite III Plus 3.55 w/menus ..... 215.

LANGUAGES

Borland International
Turbo C Prof. 2.0 ..... 164.
Turbo Pascal Prof. ..... 164.
Microsoft
Basic Prof. Dev. Sys. 7.0 ..... 310.
C Compiler 5.1 ..... 273.
QuickBasic 4.5 ..... 65.
QuickC 2.0 ..... 63.
Peter Norton
Norton Editor 1.3 ..... 40.
Solutions Systems
BRIEF 3.0 for OS/2 ..... 179.

ENTERTAINMENT & EDUCATION

Activision
Shanghai ..... 10.
The Music Studio 3.0 ..... 59.
Ad Lib
Ad Lib Music Card ..... 163.
Broderbund
New Printshop ..... 35.
Simcity ..... 29.
Where in Time is Carmen S.D. ..... 30.
Microsoft
Flight Simulator 4.0 ..... 38.
PC Globe Inc.
PC Globe 3.0 ..... 36.
PC USA ..... 36.
Spectrum Holobyte
Tetris ..... 23.
Vettel ..... 26.

by
Winn L. Rosch

Lab Notes

The New EISA Standard: Did IBM Miss the Bus?

Is combining the best ideas from existing bus designs with a number of original and clever features the way to derive a new personal computer bus standard? That's the question that has been facing EISA, the now-familiar acronym for Expanded Industry Standard Architecture.

The goal, announced on September 13, 1988, was to design a 32-bit successor to the AT bus (which EISA's designers call "Industry Standard Architecture" or ISA) that also remained compatible with it. The reality of EISA, now finally here in the form of some very powerful desktop computers, shows that the new standard goes far beyond merely specifying how to add 16 new data lines to the AT bus. By borrowing the best ideas from other bus designs—features such as bus mastering, automated setup, and interrupt sharing—and then incorporating its own new data transfer modes, EISA has become a powerful and useful expansion design.

Along the way, of course, critics have called EISA a camel: a horse designed by a committee. And in fact, the new standard *was* crafted by committee, the so-called "Gang of Nine": AST Research, Compaq Computer Corp., Epson, Hewlett-Packard Company, NEC, Olivetti, Tandy, Wyse, and Zenith Data Systems. Such was the group of once-and-future competitors that banded together to create its own standard in opposition to IBM's Micro Channel Architecture (MCA).

But while committee work often produces a compromise kludge, this particular committee worked in the opposite direction. The industry-standard bus itself had become the kludge by the time the EISA group was formed.

An ill-defined standard at best, the classic bus had grown into a position of industry dominance lacking even bus-timing specifications. These all-important timing specifications are vital for determining how expansion cards interact, and yet they were not formalized for the AT bus until several years after hundreds of manufacturers had proliferated boards without number, each following its own variation of the "standard." Needless to say, compatibility on the classic bus was chancy.

■ The long-awaited alternative to IBM's Micro Channel promises high performance with maximum compatibility.

The future of the classic bus was even more disheartening. Its poor performance and limited data handling fell far short of the needs of fast 80286-based computers, let alone 386 and 486 machines. The true task facing the EISA committee was to bring order out of this chaos.

To IBM, the original developer of the classic bus, the situation was so hopeless that the company's engineers decided the only way out was to abandon the AT-bus standard altogether. The EISA committee thought otherwise. After all, computer users had billions of dollars invested in classic-bus accessories, and the fortunes of the committee members were built upon the old architecture as well. Trying to preserve both investments, the committee created the EISA standard, brought together much of the rest of the personal computer industry, and ushered in a flurry of newly available products based upon it.

This article will give you a semitechnical overview of the new standard, showing the ideas behind its design and how they work. I won't attempt here to compare EISA with other bus standards. Such comparisons will be left to reviews of actual hardware; only existing products can demonstrate whether theoretical virtues bring real-world power.

INCREASING RIDERSHIP

The initial impetus for a new bus standard was the inability of the 16-bit AT bus to deal with the 32-bit needs of the newer Intel microprocessors (specifically the 386DX and 486). The first step in getting full performance from these chips is to move data around in the largest blocks they can manipulate in a single operation: 32-bit units, called *double words*. All else being equal, widening the data path to 32 bits can by itself double the speed of data transfers in an AT-style computer. Of course, all else never is equal, and it certainly is not in the case of EISA. But in order to gain this instant advantage over the classic bus, EISA adds 16 new data lines, as displayed in Figure 1.

The EISA designers sought to overcome another limit the classic AT bus imposes on higher-powered microprocessors. The AT bus's 24 address lines place a limit of 16MB on directly addressable memory (as opposed to bank-switched memory, like that available under the EMS standard). To successfully accommodate the full, 4GB direct-addressing abilities of the 32-bit Intel microprocessors, EISA also broadens the address bus to a full 32 bits. The new address lines are labeled with the prefix LA in the connector pinout shown in Figure 1.

EISA's contribution on this score is more generous than merely adding eight additional address lines. The standard also adds new lines for indicating some of the lower-order address bits. To some extent

SUMMARY OF THE NEW EISA SIGNALS

Bus pins	Signal name	Descriptions
16	D	Data lines
8	LA	Address lines
15	LA	Address lines
4	BE	Byte enables
1	LOCK	Bus lock
1	EX32	32-bit EISA slave indicator
1	EX16	16-bit EISA slave indicator
1	START	EISA start-of-cycle control
1	CMD	EISA end-of-cycle control
1	M-IO	EISA memory or I/O indicator
1	W-R	EISA write or read indicator
1	EXRDY	EISA ready indicator
1	MREQx	Slot specific bus request
1	MAKx	Slot specific bus grant
1	SLBURST	Burst cycle indicator from slave
1	MSBURST	Burst cycle control from master
55		Total new pins on EISA connector

Figure 1: This table shows the new EISA bus pins, respective signal names, and the definition of each signal. The new address lines are labeled with the prefix LA.

these lines duplicate the function of the classic bus, but nonetheless there is an important change. The EISA lower-order address lines (LA2 through LA16) are *latching*, in other words, they provide stable signals through the entire address cycle, not just at its beginning. The EISA address extensions (the upper 8 bits) to the classic bus also latch.

Sometimes all 32-bits of the data bus are not needed in a data transfer. For example, a program may need only to move a byte from one memory location to another. EISA provides four new signals to indicate which bytes of the double word of data on the bus are significant: the Byte Enable signals BE0 through BE3.

To maintain compatibility with as many classic-bus expansion boards as possible, EISA is designed to accommodate devices that have either 8-, 16-, or 32-bit interfaces. This diversity requires some method of preventing a device from trying to dump 32 bits of data to another that has only a 16-bit interface (in which case half the data would be lost).

EISA provides signals to indicate what size data transfers a device can handle. To indicate that it has access to the full 32 bits of the EISA bus, a device sends the EX32 signal. Similarly, the EX16 signal indicates that a device supports only 16-bit transfers. If neither signal is present, the system must assume the particular device can handle only 8 bits of data at a time. (These signals supplement those on the classic bus that indicate an 8- or 16-bit transfer width.)

But EISA doesn't stop there. The standard also provides for the automatic translation of the width of the bus signals. As illustrated in Figure 2, the 32-bit signal of an EISA card will be broken down, as needed, into four sequential 8-bit signals that can be digested painlessly by classic-bus expansion boards. A special integrated circuit, the EISA Bus Controller, moves data into the appropriate byte lanes and translates the control signals on the bus accordingly.

> To maintain compatibility with classic-bus expansion boards, EISA can accommodate devices that have either 8-, 16-, or 32-bit interfaces.

EISA goes well beyond simply providing extra signals to add new data and addressing capacity to the classic bus. Other EISA enhancements require new signals to be assigned to bus connections. These signals include support for burst-mode data transfers (MSBURST and SLBURST), new timing signals to help manage fast data transfers (START and CMD), and even a signal to slow the bus down with wait states (EXRDY).

EISA also adds slot-specific signals for managing bus arbitration (MREQx and MAKx), which will be discussed next time. Another slot-specific signal, which redefines a signal assignment on the classic bus, is now called AENx. It enables each expansion board to respond independently of the others so that each board can be individually addressed and controlled.

The x in the signal names is simply replaced by the hexadecimal designation of the slot. The designations of these slot-specific signals reflect EISA's design maximum of 15 expansion slots per system. However, the specification states that systems with any more than eight slots are unlikely.

Under EISA, all the other signals on the classic bus retain their former definitions and functions. This provision was necessary to maintain backward compatibility with older expansion boards. The big challenge faced by the EISA engineers was to fit all these signals on a connector that would still allow the use of old expansion boards.

REVERSE GEAR

You can bet that great care was taken to minimize physical differences between the expansion boards used by the classic bus and those adhering to the EISA standard. Compatibility is EISA's whole *raison d'être* and perhaps its biggest selling point against other new bus standards. Under EISA, all existing PC expansion boards are designed to be plug-compatible with newer, high-performance EISA computers, although the opposite is not true and some exceptions do exist.

The physical specifications of the old and new standards are therefore very similar. EISA expansion boards are the same size and shape as AT boards, the standard-setting maximum dimensions of 13.415 inches long and 4.5 inches high (from the top of the board to its bottom edge). Small-

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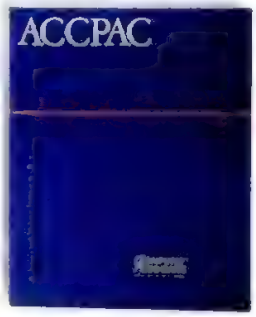

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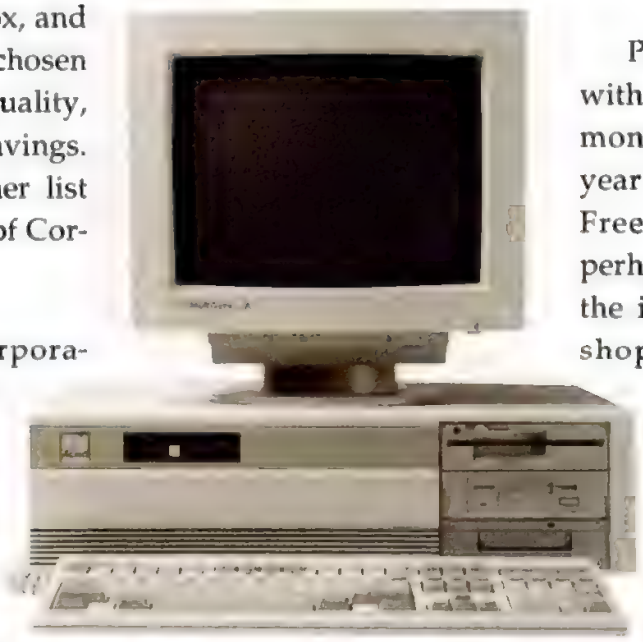

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er boards, such as so-called "short cards," are still accepted. But EISA makes some specific dimensional changes to ensure that future products will be even more size-compatible than PC boards are today.

One seemingly minor change holds the potential for making a major difference. All measurements for EISA boards are specified from a common origin—that is, you measure all dimensions from a common starting point. For EISA, that point is the center of the expansion connector, not an edge of the card. As a result, tolerances are smallest and the board fit is best where it counts most, at the expansion connector. EISA boards should fit better than their predecessors.

Another EISA change may have greater implications for existing PC expansion boards. While EISA accepts all physical configurations of *current* expansion boards, it prohibits the addition of *skirts* on future products. These are the areas on a board that dip down below the expansion connector and provide slightly more space for componentry along the long bottom edge of the board. As can be seen in Figure 3, however, EISA does permit a *miniskirt*, namely, one located between the expansion connector and card-retaining bracket. The implication is clear, however: as with current computers, not all slots in EISA machines will allow the insertion of boards with skirts.

The centerpiece of the EISA specification is its expansion connector, which is shown in Figure 4. It is this connector design that permits backward compatibility with PC-bus cards while at the same time allowing full 32-bit expandability of EISA peripherals. It adds 90 new connections (55 new signals) without increasing the size of the connector itself, and it accepts both EISA and classic-bus boards without difficulty.

The clever two-tier design of this connector actually represents a revision of the original EISA concept. The EISA connector that was originally announced in 1988 relied on what was in effect two parallel connectors—one that provided the compatible link-up with existing expansion boards and a second connector, offset from the expansion board, for 32-bit data transfers and addressing.

The original connector design was criticized for various deficiencies, including its need for inordinately high insertion force. The amount of effort deemed necessary to push a board into the slots of the parallel connector was so high that it nearly precluded using cost-saving automatic insertion machinery to build new computers!

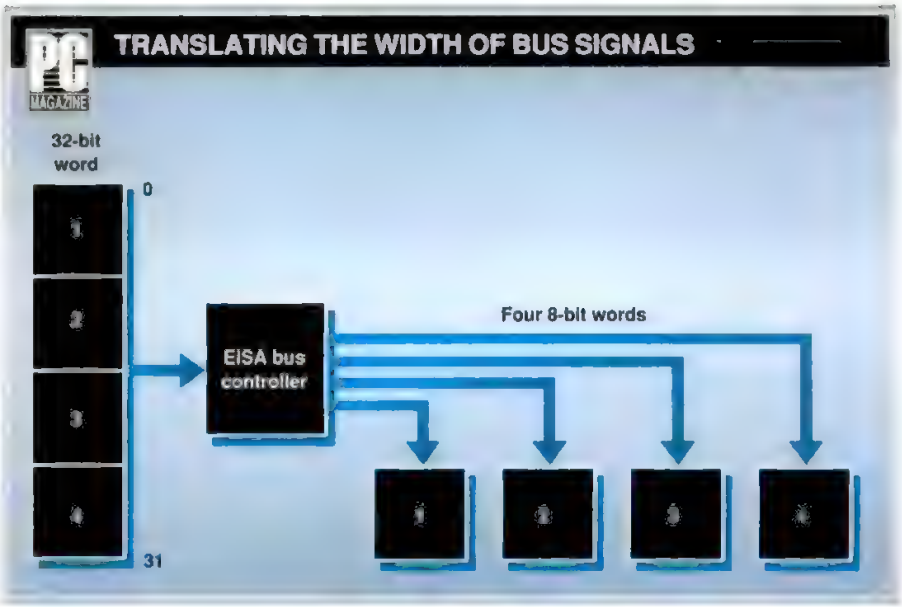

Figure 2: Instead of forcing EISA expansion boards to negotiate each bus transaction down to the least common denominator—limiting transfers across the bus to the width of the narrower of the two parties in the transaction—the EISA Bus Controller automatically manages the transfers. As necessary it automatically translates signals into the appropriate bus width for the target board while also accommodating the highest-speed EISA boards. For example, it can serialize the bytes of a 32-bit transfer into four sequential 8-bit transfers for a classic-bus expansion board.

> The EISA expansion connector permits backward compatibility with PC-bus cards while allowing full 32-bit expandability of EISA peripherals.

Because the new EISA connector is physically the same size as a traditional expansion connector, it requires about the same insertion force of 35 pounds—not the 100-plus pounds estimated for the proposed parallel connector. This, of course, poses no problems for automatic insertion machinery.

The new connector achieves its combination of compatibility and full 32-bit expandability by branching out vertically instead of horizontally. In the new EISA connector, the contacts for enhanced functions are built into a second, lower level. Existing PC expansion boards can be inserted only about halfway into EISA slots, and so engage only the PC bus contacts. Five keys—plastic stops molded into the EISA connector—prevent these older boards from going further in. EISA boards have cutouts that fit into the keys and so permit full-depth insertion into the connector. Once the card is fully inserted, upper and lower sets of contacts engage separate sets of pads on the EISA board. Because of its need for this deeper insertion, the edge connector on an EISA board is consequently a bit longer (about 0.2 inch) than that of a classic-bus board.

The keying scheme prevents old-bus cards from shorting out the EISA connections, which could damage the EISA computer. Nothing stops EISA boards from physically fitting into ordinary 16-bit AT expansion slots, however. In fact, because of the odd arrangement of contacts on EISA boards, inadvertently inserting an EISA board into an old AT connector could send signals into the wrong circuits.

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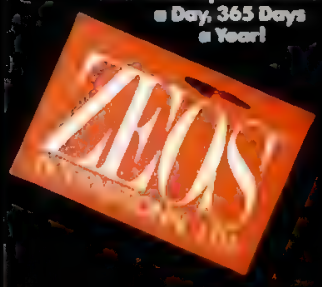


You won't blow anything up, but you can temporarily render the host system dysfunctional. Consequently, EISA boards should never be inserted into non-EISA computers, even though they will physically fit into the slots.

EISA also strives to maintain compatibility with the power demands of old-bus expansion boards. Under the EISA specification, a generous amount of power is assumed to be available for each expansion slot, freeing peripheral designers from the need to use special low-power components. More than 45 watts, at four different voltages, are theoretically available at each EISA expansion slot.

Of course, such availability takes an optimistic view of the total reserves of the system power supply. Filling the eight slots envisioned in a complete EISA system with hungry expansion boards would require over 325 watts. Even without considering the needs of mass storage devices and the system board itself, a fully-expanded EISA computer would require a huge power supply. On the other hand, nothing about the EISA design requires expansion boards to use any more power than old-bus cards, so traditional power levels are likely to be adequate in practice.

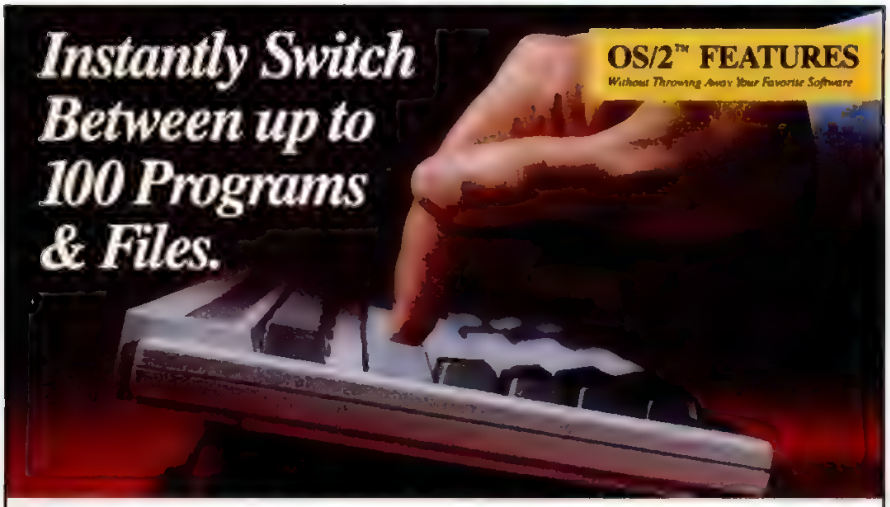
RACING THE BUS

Compatibility is also among the most formidable problems in squeezing more raw speed—more megahertz—from the AT bus. Simply increasing the clock speed that synchronizes data transfers across the bus is out of the question for EISA, because any speed increase can cause problems for existing expansion boards. Many classic bus boards just won't operate at bus speeds much higher than the 8 MHz used in the AT or the 10 MHz used by some compatibles.

> Under EISA specifications, a generous amount of power is assumed to be available for each expansion slot, freeing peripheral designers from the need to use special low-power components.

As a consequence, EISA does not increase the raw speed of the clock driving the expansion bus. The specification calls for a bus clock (BCLK) that oscillates at a fixed rate between 6 and 8.33 MHz. Note that the latter figure is one-quarter the 33-MHz clock speed of today's fastest microprocessors.

The bus speed is a submultiple of the system clock frequency because the EISA



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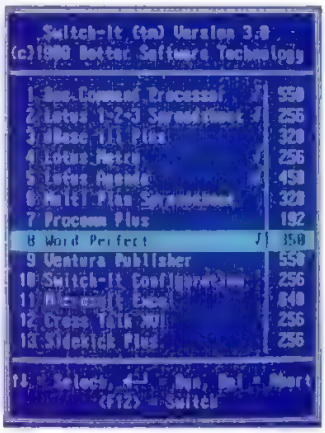

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is nominally a synchronous bus—it operates in lockstep with the host microprocessor. But not necessarily. Bus masters can take over control and alter some aspects of system timing to achieve higher data throughputs.

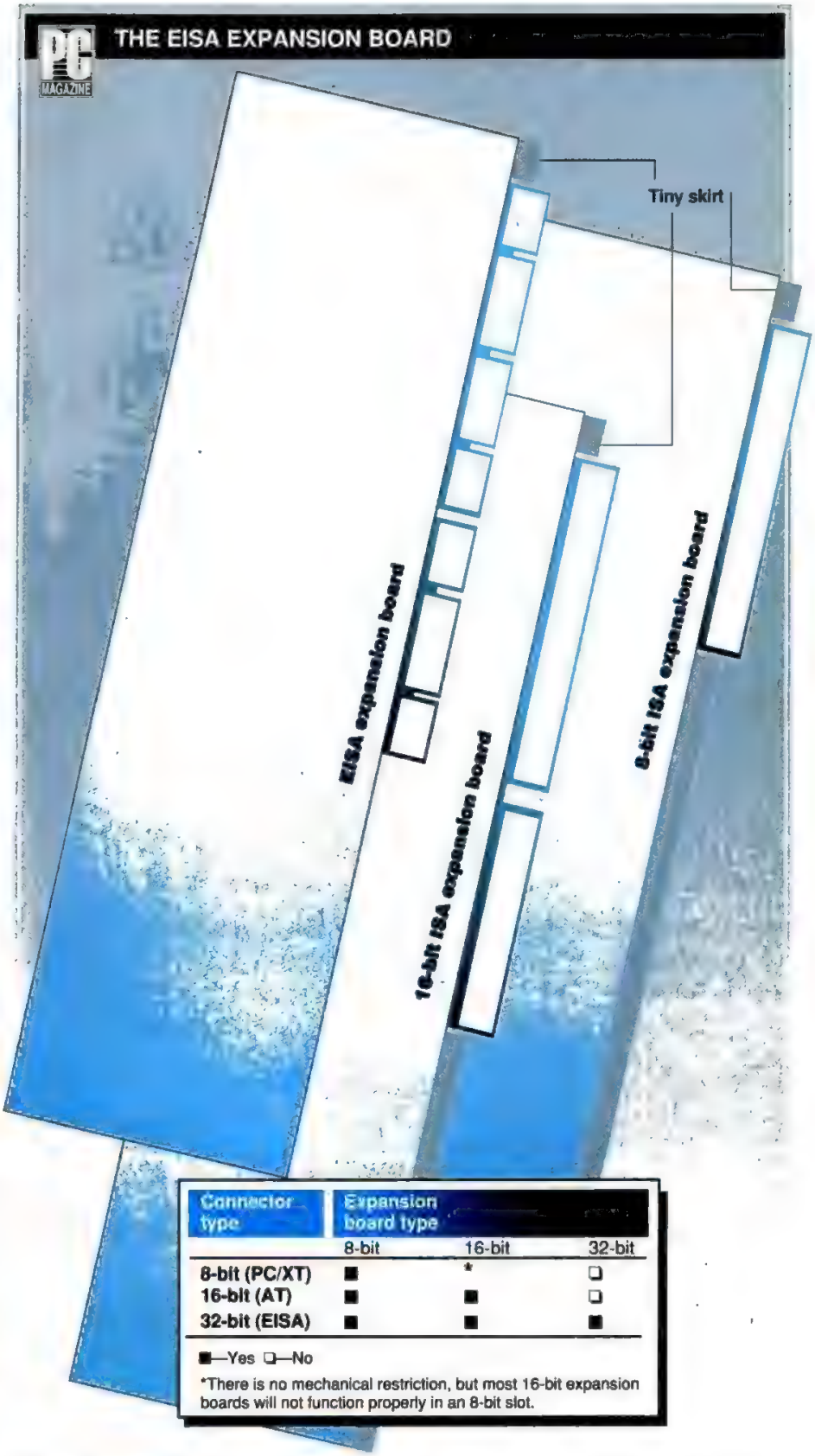
Such altered timings are necessary because the bus speed limit is more severe than the MHz number would imply. The actual data transfer rate of the classic bus never reaches the 16MB per second the bus might theoretically allow, for the classic bus cannot move data in each clock cycle. Rather, every byte that gets transferred must go through an elaborate hierarchy of commands. At best every transfer requires

> EISA supports not only the data transfer method of the classic bus, but also two faster schemes of its own: compressed transfers and burst mode.

at least two bus cycles: one during which the memory address is specified, then a second during which the specified memory location is actually read. Wait states and other addressing needs can add more bus cycles and stretch out the transfer time even longer.

Although EISA allows this old data transfer method, it also adds two faster schemes of its own: compressed transfers and burst mode. Compressed transfers are 50 percent faster because data is moved every 1½ bus cycles. Burst mode moves data every cycle, resulting in an effective transfer rate of 33MB per second (8.33-MHz bus speed and 32-bit data path).

Compressed cycles rely on a special EISA Command timing signal (CMD) that supplements the bus clock. While compressed transfers are taking place, the CMD signal operates at twice the speed of the bus clock, and the data transfer is re-



Connector type	Expansion board type		
	8-bit	16-bit	32-bit
8-bit (PC/XT)	■	*	❑
16-bit (AT)	■	■	❑
32-bit (EISA)	■	■	■

■—Yes ❑—No

*There is no mechanical restriction, but most 16-bit expansion boards will not function properly in an 8-bit slot.

Figure 3: The EISA specification tries to eliminate subtle physical incompatibilities among expansion boards and some systems. One of these is skirts—areas where the board extends down to accommodate more circuitry. Although the specification acknowledges the skirts of some boards, it prohibits them from new products. But a tiny skirt near the retaining bracket is permitted.

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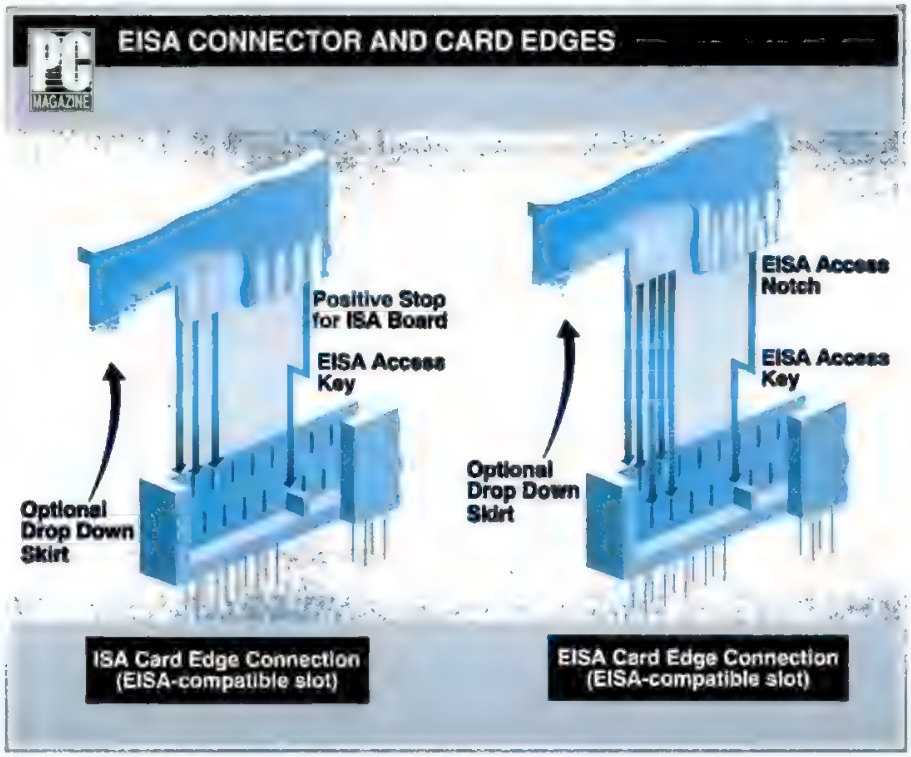

Figure 4: The EISA connector ingeniously doubles the number of contacts on a low-cost edge connector no larger than that used by AT computers. The edge connector on each expansion board puts its connections in two vertically separated rows, interleaving the circuit traces of the new contacts (the lower row) between those of the upper row. The edge connector on EISA boards plugs in more deeply than that of a classic-bus board, so classic boards can safely be plugged into EISA sockets and connect properly. Although nothing prevents plugging an EISA board into a classic-bus socket, this action is prohibited; it can damage the board, the host computer, or both.

quired to take place during its duration.

In burst mode, the addresses for data transfer are asserted at the beginning (for writing data) or at the end (for reading data) of every clock cycle. The data is actually put on the bus 1/2 or 1 1/2 cycles later, and is again locked to CMD.

The EISA burst data mode has both advantages and limitations. Unlike a *streaming data* mode, in which only a starting address is specified, EISA burst mode can move noncontiguous data, because an address is given with each transfer. However, EISA allows only the least significant 10 address bits to change during a burst cycle. This effectively limits burst data transfers to addresses within a block of 1,024 double words in memory. Moreover, EISA does not permit reads and writes to be mixed in a single burst, because of the differences in the timing between these signals.

Moreover, you must not confuse the fast 33-mega*byte*-per-second maximum data transfer rate with the even faster 33-mega*hertz* operation of top-of-the-line PCs. While both the EISA bus and the system memory of these computers is 32 bits wide, the maximum EISA bus clock speed remains 8.33 MHz, effectively one-quarter the speed of system board memory. In other words, in EISA computers, slotted memory will still be slower than system board memory, just as it is in classic-bus machines. High performance (which, for practical purposes, means all) EISA computers will still be built with proprietary memory expansion slots that operate at the full speed of the system (not the bus) clock.

Next time, I'll conclude this overview of the new EISA standard by considering such issues as direct memory access, interrupt handling, bus arbitration, and setup procedures. ■

Winn L. Rosch is a contributing editor of PC Magazine.

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Utilities

Getting a Good Look at How DOS Allocates Your Memory Blocks

What do you do when DOS tells you that the new program you're trying to load is too big to fit into memory? Or when an application refuses to install for the same reason? Usually, you start REMing out the names of one or two of the less crucial memory-resident (TSR) programs listed in your AUTOEXEC.BAT file and reboot, and after several tries (or after removing them all initially) you manage to get your new application running. Then, again by trial and error, you see which of your TSRs you can put back safely. You never do learn how much memory any of your programs actually occupies.

MEMMAP.EXE lets you make a more informed choice. MEMMAP is a DOS utility that displays all allocated memory blocks, including terminate-and-stay-resident (TSR) programs and their associated environment memory blocks. When used with the optional /V switch, MEMMAP will also display the variables in each environment block. The program has been tested and found to work with DOS 2.10, 3.3, 4.0, and with the OS/2 Extended Edition 1.1 DOS Command subset.

There are, of course, other memory-mapping utilities available, but I have found that a number of them behave erratically when IBM's Workstation Program (INDCIPL.EXE) and Expanded Memory Manager (INDXMAA.SYS) are in memory (see the sidebar "A Memory Enigma"). *PC Magazine*'s own PCMAP .COM (published as a sidebar to Lab Notes in the August 1987 issue) aggregates both environment and program blocks, which creates two problems: (1) the memory entries are not always listed in ascending order; (2) size information about individual environment blocks is not available. I wanted a program that would help me determine how much memory was being lost to needless environment variables that were saved every time a TSR was loaded into memory.

Moreover, when run under DOS 4.0, PCMAP returns <unknown> for most program names. DOS 4.0's own MEM /DEBUG facility, on the other hand, is not available in DOS 3.*x*. Since MEM is a new command under DOS 4.0 and therefore cannot be run on earlier DOS versions, a common program that operates under both DOS 3.*x* and 4.*x* seemed desirable. Then too, the DOS 4.0 MEM command reports block sizes only in hexadecimal bytes. For example, *SideKick* (SKM) is listed as being 7,180h bytes long instead of the 29,056 (decimal) bytes that is more meaningful to most PC users.

Finally—and with an admittedly personal motive—I wanted to show that Turbo Pascal can be used to write system utilities as easily as assembly language or C. In particular, MEMMAP demonstrates the ability of Turbo Pascal to manipulate DOS system control blocks using pointer variables and record types.

■ MEMMAP is a Turbo Pascal 5.0 program designed to display all memory blocks allocated by DOS.

MEMMAP RUNNING UNDER DOS 4.0

MemMap (Version 2, May 89)

Memory Control Block Segment	Block Size [Bytes] Hex	Block Size [Bytes] Decimal	Owner Segment	Type	Name
0B40	02FE0	12256	0008	System	<DOS 4.0 kernel>
0E3F	01640	5696	0E40	Program	<shell>
0FA4	00030	48	0000	Free Space	<unallocated>
0FA8	000A0	160	0E40	Environment	<shell>
0FB3	00040	64	1E9B	Environment	A:\MEMMAP.EXE
0FB8	00040	64	130B	Environment	A:\TSR\DOSED.COM
0FBD	01E20	7712	0FBE	Program	APPEND
11A0	014A0	5280	11A1	Program	GRAPHICS
12EB	001E0	480	12EC	Program	MODE
130A	00A20	2592	130B	Program	A:\TSR\DOSED.COM
13AD	00040	64	13B3	Environment	A:\PCMAG\INSTALL.COM
13B2	005F0	1520	13B3	Program	A:\PCMAG\INSTALL.COM
1412	00040	64	1548	Environment	A:\PCMAG\CONFIRM.COM
1417	012F0	4848	1418	Program	CAPTURE
1547	001C0	448	1548	Program	A:\PCMAG\CONFIRM.COM
1564	00040	64	170C	Environment	A:\PCMAG\POP-CAL.COM
1569	006F0	1776	156A	Program	PRN2FILE
15D9	01000	4096	156A	Data	PRN2FILE
16DA	00300	768	16DB	Program	PUSHDIR
170B	00700	1792	170C	Program	A:\PCMAG\POP-CAL.COM
177C	00040	64	1782	Environment	A:\SIDEKICK\SKM.COM
1781	07180	29056	1782	Program	A:\SIDEKICK\SKM.COM
1E9A	02920	10528	1E9B	Program	A:\MEMMAP.EXE
212D	7E920	518432	0000	Free Space	<unallocated>

Figure 1: MEMMAP uses DOS 4.0's ability to identify program names stored in the block owner's MCB. Under DOS 3.3, CAPTURE, PRN2FILE, and PUSHDIR are reported as <unknown>.

USING MEMMAP

You can download MEMMAP.EXE and its source code from PC MagNet. Instructions are in the sidebar "PC Utilities By Modem." In recent months, the source code for this column hasn't appeared so that we can publish more columns, and thereby provide more tips. But, in this issue we've made room. We'll print future programs whenever we can make room.

The full syntax for MEMMAP.EXE is

```
MEMMAP [/V]
```

When run from the DOS 4.0 prompt without its optional /V parameter, MEMMAP will produce a screen display similar to that shown in Figure 1. As explained below, some program names will be reported as <unknown> under earlier versions of DOS. When the optional /V switch is specified, MEMMAP will show the environment variables (COMSPEC, PATH, PROMPT, and so on) that are loaded with each program, as seen in Figure 2. The display in Figure 2 was actually obtained while running under OS/2 Extended Edition 1.1, whose kernel identifies itself as 10.10, but it is otherwise similar to what would be produced under DOS 3.3.

Inspection of Figure 2 also shows that you can minimize wasted memory by following several rules:

- Load TSRs with the smallest possible set of environment variables in effect. If possible, reduce the set to COMSPEC and a very short PATH.
- In AUTOEXEC.BAT files, load TSRs before PATH or any SET commands if possible. Use fully qualified names to load TSRs so that the PATH can be reduced.
- Never reexecute AUTOEXEC.BAT after boot-up if it contains TSRs that reinstall themselves multiple times. Many TSRs, unfortunately, do not check to see if they are already resident. MEMMAP will quickly show when a TSR is loaded into memory multiple times, of course.

USING MEMMAP'S /V OPTION

```
Memory
Control     Block Size
Block         [Bytes]        Owner
Segment     Hex    Decimal   Segment      Type              Name
-------   -------  -------   -------   ------------   ----------------------
  2602    007B0      1968      FFFF     System         <DOS 10.10 kernel>
  267E    00AA0      2720      267F     Program        <shell>
  2729    00030        48      0000     Free Space     <unallocated>
  272D    000A0       160      267F     Environment    <shell>

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  2738    00060        96      2740     Environment    C:\OS2\APPEND.EXE

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM

  273F    013B0      5040      2740     Program        C:\OS2\APPEND.EXE
  287B    00040        64      0000     Free Space     <unallocated>
  2880    00070       112      2889     Environment    A:\TSR\DOSED.COM

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  2888    00A20      2592      2889     Program        A:\TSR\DOSED.COM
  292B    00070       112      2934     Environment    A:\PCMAG\INSTALL.COM

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  2933    005F0      1520      2934     Program        A:\PCMAG\INSTALL.COM
  2993    00070       112      2ACC     Environment    A:\PCMAG\CONFIRM.COM

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  299B    012F0      4848      299C     Program        <unknown>
  2ACB    001C0       448      2ACC     Program        A:\PCMAG\CONFIRM.COM
  2AE8    00070       112      2C93     Environment    A:\PCMAG\POP-CAL.COM

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  2AF0    006F0      1776      2AF1     Program        <unknown>
  2B60    01000      4096      2AF1     Data           <unknown>
  2C61    00300       768      2C62     Program        <unknown>
  2C92    00700      1792      2C93     Program        A:\PCMAG\POP-CAL.COM
  2D03    00070       112      2D0C     Environment    A:\SIDEKICK\SKM.COM

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  2D0B    07180     29056      2D0C     Program        A:\SIDEKICK\SKM.COM
  3424    00070       112      342D     Environment    A:\MEMMAP.EXE

PATH=C:\MENU;C:\OS2;C:\OS2\SYSTEM;C:\
COMSPEC=C:\OS2\COMMAND.COM
PROMPT=$T$_$P$B$G

  342C    02790     10128      342D     Program        A:\MEMMAP.EXE
  36A6    69170    430448      0000     Free Space     <unallocated>
```

Figure 2: This sample output was produced while running under the OS/2 EE 1.1 DOS Command subset. As with DOS 3.3, a number of program names are reported as <unknown>. Note that DOS reports itself as the <10.10 kernel>.

OPERATIONAL OVERVIEW

The layout of DOS user memory is shown in Figure 3. Following the DOS system area, each memory block is preceded by a memory control block (MCB). As shown in Figure 4, the MCB stores information on the owner of the block and the size of the memory block. Once MEMMAP locates the initial MCB, the next MCB follows the memory block itself. Thus, all user memory can be mapped by stepping through the MCBs. The last MCB is tagged differently from the others, so a termination condition is easily recognized.

A program finds the address of the initial memory control block—the so-called DOS "List of Lists"—by either of two methods: by searching through memory at paragraph boundaries, or by using the undocumented function call 52h of DOS interrupt 21h. MEMMAP uses the latter, simpler approach. At an offset of –2 in this List of Lists is the segment address of the first MCB.

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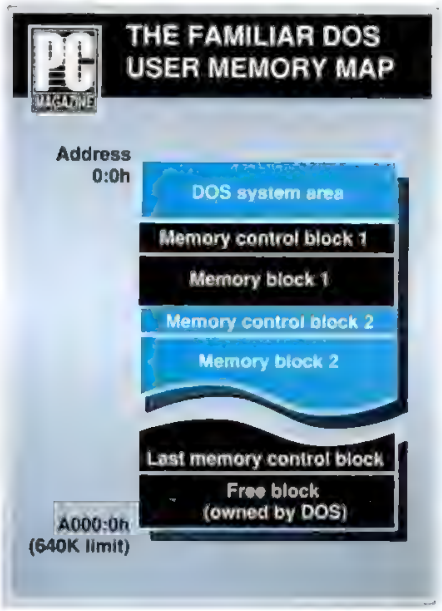


Figure 3: A DOS memory address consists of a segment:offset pair. The beginning of each memory paragraph (a 16-byte memory block) can be addressed with segment:0.

The MCB's type is determined by observing a number of relationships. If the MCB owner is 0000h, the block following the MCB is not allocated and MEMMAP designates its type as Free Space. When the first word of the paragraph following the MCB is 20CDh (or possibly 27CDh), the block type is Program—but only if the owner field points to this next paragraph; otherwise, the owner is assumed to be the DOS kernel and the block type is shown as System. Figure 5 diagrams and explains these relationships. The block type is Environment when the block's owner has an environment pointer back to the paragraph following the MCB. When none of the above relationships hold, MEMMAP assumes the block is a Data type. (One TSR that I've found with a Data memory block is *PC Magazine*'s PRN2FILE).

The name of an MCB is determined from the environment block when possible. In DOS 3.*x*, the fully qualified program name follows the environment value(s) and a special tag word, 0001h, as shown in Figure 5. When an environment block does not exist for a program or when the program name does not follow the environment block, a "short" program name (from one to eight characters) can be found in the last half of the MCB—but only in DOS 4.0. In earlier DOS versions, when such a case occurs, MEMMAP designates the name as <unknown>.

The current environment variables maintained by DOS are contained in the first environment block with the name <shell>. The size of this first block is 160 bytes in the output report shown in Figure 1, since that is the default environment size. The size of this first environment block can be increased by adding a statement to the CONFIG.SYS file (and rebooting, of course). For example, to increase the environment space to 512 bytes, add the following to CONFIG.SYS:

```
SHELL=\COMMAND.COM /P /E:512
```

In addition to the working set of environment variables set up at boot time, DOS makes a copy of the variables in effect at the time a TSR is loaded. The size of each of these environment blocks is adjusted to accommodate only the variables set at the time the TSR is loaded. This is why DOS 3.3 and OS/2 EE 1.1 show ten environment blocks (Figure 2) and DOS 4.0 shows seven environment blocks (Figure 1). Apparently, the DOS 4.0 commands APPEND, GRAPHICS, and MODE are now intelligent enough not to make copies of the environment variables. (For further discussion of MCBs and DOS environments, see Barry Simon's Lab Notes article "Providing Program Access to the Real DOS Environment," in the November 28, 1989, issue.)

IMPLEMENTATION IN TURBO PASCAL 5.0

Pointers are usually used to address dynamic variables created with the standard Pascal NEW procedure (or Turbo Pascal's GetMem procedure), but pointers can also be used to manipulate existing data structures, such as DOS memory blocks. The MEMMAP.PAS source code, available via PC MagNet, as indicated above, provides an example of accessing DOS's List of Lists, memory control blocks, and the Program Segment Prefix (PSP) blocks by using pointer variables.

To obtain the address of the DOS List of Lists, the undocumented function call 52h of DOS interrupt 21h is needed. The DOS Turbo Pascal UNIT provides the Intr procedure and Registers type:

```
        .
        .
VAR r:  Registers;  {line  57}
        .
        .
r.AH := $52;        {line 205}
Intr ($21,r);       {line 206}
```

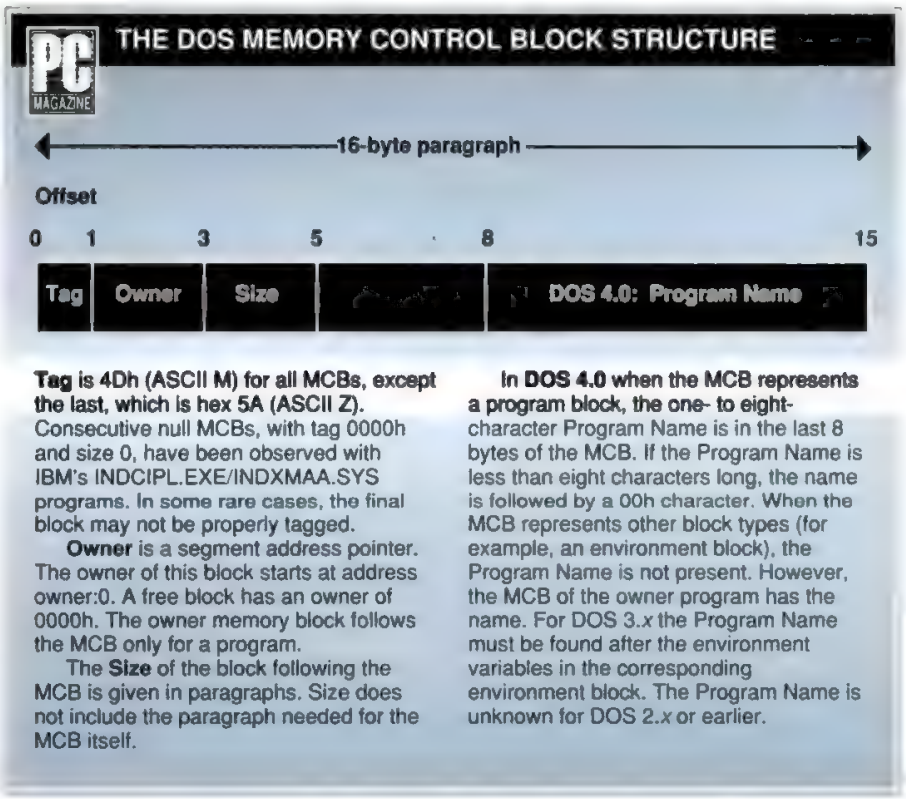
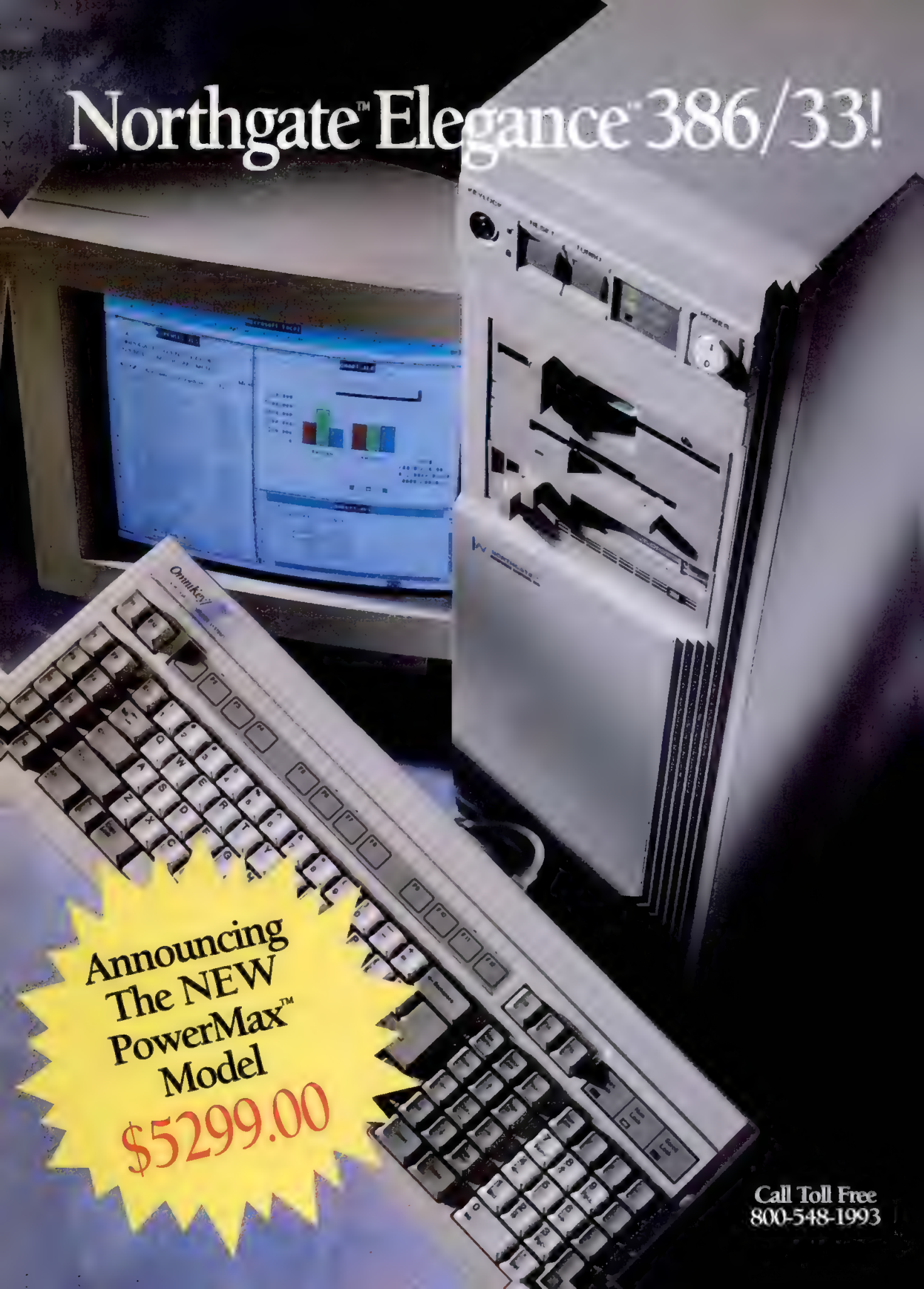


Figure 4: Each block of user memory is preceded by a memory control block (MCB), which stores information about the owner and size of the block.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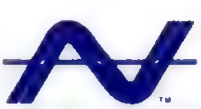

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This leaves a pointer to the List of Lists in ES:BX. At an offset of –2 in the List of Lists is the segment address of the first memory control block:

```
segment := MemW[r.ES:r.BX-2];
 {line 207}
```

where the MemW Turbo Pascal system array returns the word at the given segment: offset address. The MCB pointer variable is then defined using the Turbo Pascal Ptr procedure:

```
MCB := Ptr(segment,0); {line 210}
```

Now all variables defined by the memory control block TYPE can be accessed.

MEMMAP lets you manipulate DOS memory control blocks.

Typecasting will help calculate the size of the memory block following the MCB:

```
bytes := LongInt(MCB^.BlockSize)
 SHL 4; {line 102}
```

If the MCB^.BlockOwner is zero, the block is free space. If it is nonzero, the MCB^.BlockOwner points to a memory block that is a valid program segment prefix if it starts with the word 20CDh (or possibly 27CDh). The PSP pointer is defined by the following:

```
psp := Ptr(MCB^.BlockOwner,0);
 {line 109}
```

A segment pointer to the environment block is at an offset of 2Ch from the start of the PSP, which is defined by psp^.Environment. The environment block must be immediately preceded by an MCB, so the environment MCB is defined by

```
MCBenv := Ptr(psp^.Environment-
1,0); {line 116}
```

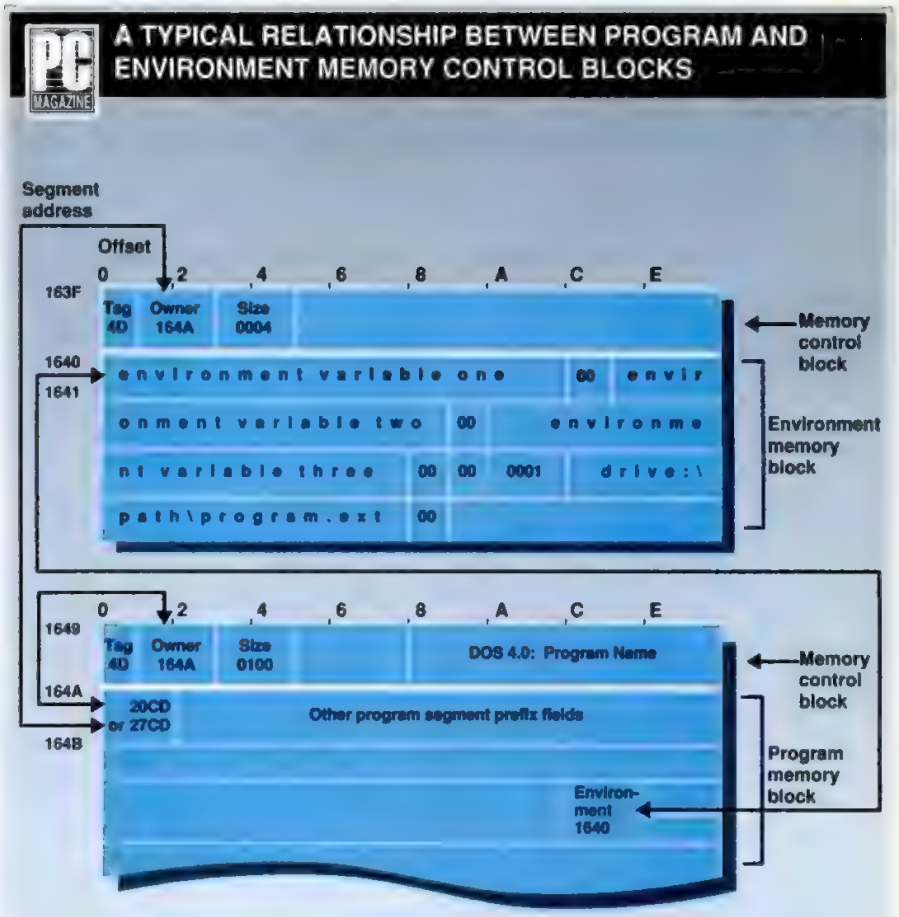

DIAGRAM NOTES:

Numeric values are all in hexadecimal.

All addresses and pointers are paragraph (segment) references. For example, the address of the 163F paragraph is 163F:0.

Size values are in paragraphs (16 bytes).

Hex word values are stored in memory with bytes swapped but are not shown thus above.

When the MCB owner is 0000, the block following is unallocated.

An MCB represents a "program" when the next paragraph starts with 20CD or 27CD. If the Owner is not the paragraph following the MCB, the Owner must be the DOS kernel. When the Owner immediately follows the MCB, its name (without the path) can be found in the MCB, but only in DOS 4.0. In DOS 3.*x*, the name can be found by looking at the environment pointer and scanning past the environment variables (see below).

An MCB represents an "Environment" when the Owner's Environment pointer points to the paragraph following the MCB. In the example above, the MCB at 163F points to its owner at 164A. The Environment pointer, which is at offset 2C in the owner block, points to the block at 1640, which is the paragraph following the MCB at 163F.

The environment variables are in ASCIIZ form following the environment MCB; that is, each text variable is terminated with hex 00. The last variable is followed by a second 00. In DOS 3.0 and later, the next word is 0001 and it is followed by the fully qualified program name.

Any block can be displayed using DEBUG. To display the environment MCB and memory block above, enter

```
>debug
-d 163f:0 4f
-q
```

Figure 5: The relationships between program and environment determines the MCB type.

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CIRCLE 293 ON READER SERVICE CARD

If the MCB^.BlockOwner is the same as the MCBenv^.BlockOwner, environment variables follow in ASCIIZ-delimited strings (character strings ending with a $00). A null (zero-length) variable marks the end of the environment. The program name follows the special $0001 tag.

Once an MCB and its associated information is displayed, the segment address of the next MCB can be found by the statement:

```
segment := segment +
MCB^.Blocksize + 1; {line 212}
```

The extra 1 above is needed because the MCB is itself a single paragraph long.

Contiguous MCBs and memory blocks can be sequentially listed until the last MCB is found, which is tagged with MCB^.Blocktag = $5A.

A final note: *do not* use DISPOSE (or FreeMem) to deallocate a pointer variable that was not allocated using NEW (or GetMem). Since the DOS control blocks described above are allocated outside of MEMMAP, they should not be deallocated by MEMMAP.

MEMMAP demonstrates how easily Turbo Pascal can manipulate DOS control blocks using pointer variables and record types. MEMMAP has 215 Pascal lines and creates a 6,128-byte .EXE file. By contrast, PCMAP has 300 assembly language statements and creates a 643-byte .COM

A MEMORY ENIGMA

The IBM Workstation Program (INDCIPL.EXE), which allows both mainframe host sessions and PC sessions (switchable via a hotkey), presents some interesting anomalies that readers who have both MEMMAP and the previously published PCMAP utility can discover. Depending on just how you configure INDCIPL, DOS conventional memory can be very limited, even when the IBM Expanded Memory Manager (INDXMAA.SYS) is used.

MEMMAP uses information about MCBs that is still undocumented.

Figure A shows the state of DOS conventional memory from a PC session under INDCIPL as it is presented by PCMAP and MEMMAP. Both programs report a large number of "null" MCBs, that is, MCBs that point to zero-length memory blocks. The reason why the two programs are not consistent, however, and the reason why only a portion of conventional memory appears to be available has not yet been explained. This should perhaps not be surprising when you consider that much of the information used by PCMAP and MEMMAP is still undocumented. Information about MCBs is not in the IBM DOS 3.3 *Technical Reference Manual*, but rather in books such as The Waite Group's *MS-DOS Developer's Guide*.

The null MCBs appear to be a trick to reserve large memory chunks and make them unavailable to "normal" DOS applications. In the two MEMMAP cases shown in Figure A, a 51K chunk and a 312K chunk of memory are taken up with consecutive null MCBs that appear to be placeholders.—*Earl F. Glynn* ■

If any reader can shed more light on the mysteries involving IBM's INDCIPL program, we would like to hear from you.—Ed.

A PC SESSION UNDER IBM'S INDCIPL.EXE

```
PCMAP
-----------------------------------------------------------------------

PCMAP 1.0 (c) 1987, Ziff-Davis Publishing Corp.
Segment Paragraphs      Bytes       Program
0BE7H      00E0H         3584       COMMAND.COM
0CD2H      172BH        94896       INDCIPL.EXE
23F8H      271CH       160192       (Free)
4B15H      0000H           00       (Free)

 ... 249 lines like above deleted

4C0FH      0000H           00       (Free)
4C10H      0000H           00       (Free) (Free space)


MEMMAP
-----------------------------------------------------------------------

Memory                                          MemMap (Version 2, May 89)
Control      Block Size
Block         [Bytes]        Owner
Segment     Hex   Decimal   Segment      Type              Name
-------   ------- -------   -------   ------------   ---------------------
  09BA    022B0     8880     0008     System         <DOS 3.30 kernel>
  0BE6    00D30     3376     0BE7     Program        <shell>
  0CBA    00030       48     0BE7     Data           <shell>
  0CBE    000A0      160     0BE7     Environment    <shell>
  0CC9    00070      112     0CD2     Environment    C:\WSP112\INDCIPL.EXE
  0CD1    00000      128     0CD2     Program        C:\WSP112\INDCIPL.EXE
  0CDA    171C0    94656     0CD2     Data           C:\WSP112\INDCIPL.EXE
  23F7    271C0   160192     0000     Free Space     <unallocated>
  4B14    00000        0     0000     Free Space     <unallocated>
  3283 contiguous MCBs pointing to empty blocks not shown.


MEMMAP (after warm boot from PC session)
-----------------------------------------------------------------------

  ... (as above) ...
  4B14    00000        0     0000     Free Space     <unallocated>
 19995 contiguous MCBs pointing to empty blocks not shown.
Unknown Memory Control Block Tag '32'.
MemMap scan terminated.
```

Figure A: The DOS conventional memory from a PC session under IBM's Workstation Program for both PCMAP and MEMMAP.

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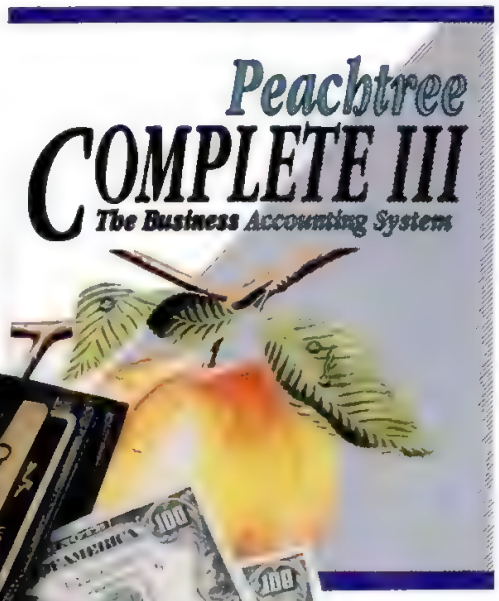

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CIRCLE 358 ON READER SERVICE CARD

MEMMAP.PAS — COMPLETE LISTING

```
{$M 4000,0,0}
PROGRAM MemMap;

 {MemMap shows a Memory Map of all programs and environment blocks.

  Usage:  MEMMAP        to show all Memory Control Blocks (MCBs)
       or
          MEMMAP /V     to show MCBs and all environment variables
                        (the /V option is ignored in DOS 2.X or lower)

  MEMMAP (C) Copyright 1990 Ziff Communications Co.
  PC Magazine, Earl F. Glynn.

  This program may be freely distributed for non-commercial use.

  MemMap is based on PCMAP from PC Magazine, SHOWMEM from "The
  Waite's Group MS-DOS Developer's Guide" (Second Edition), and
  the DOS 4.0  MEM /DEBUG  command.

  Version 1.0 -- 27 February 1989.

  Version 2.0 -- 17 May 1989.
    Modifications were made to handle IBM's INDCIPL program (part of
    the 3270 Workstation Program).  Memory with it has a large number
    of contiguous MCBs each pointing to a zero-length block.  Termination
    conditions were modified to avoid possible problems when an MCB
    is not tagged "correctly".)


USES DOS;    (DOSVersion,Intr,Registers)

CONST
  EnvironmentBlock:  STRING[12] = 'Environment ';
  ProgramBlock     :  STRING[12] = 'Program     ';

TYPE
  MemoryControlBlock =      {MCB -- only needed fields are shown}
    RECORD
      Blocktag   :  BYTE;  {tag is M ($4D) except last is Z ($5A))}
      BlockOwner :  WORD;  {if nonzero, process identifier, usually PID}
      BlockSize  :  WORD;  {size in 16-byte paragraphs (excludes MCB)}
      misc       :  ARRAY[1..3] OF BYTE;  {placeholder}
      ProgramName:  ARRAY[1..8] OF CHAR   {only used by DOS 4.0; ASCIIZ}
    END;                    {PID normally taken from PSP}
  ProgramSegmentPrefix =    {PSP -- only needed fields are shown}
    RECORD                                          { offset }
      PSPtag     :  WORD;  { $20CD or $27CD if PSP}  { 00 $00 }
      misc       :  ARRAY[1..21] OF WORD;            { 02 $02 }
      Environment:  WORD                             { 44 $2C }
    END;

VAR
  DOSVerNum:  BYTE;         {major version number, e.g., 3 for 3.X}
  LastSize :  WORD;         {used to detect multiple null MCBs}
  MCB      :  ^MemoryControlBlock;
  NullMCB  :  WORD;         {counter of MCBs pointing to 0-length blocks}
  r        :  Registers;    {TYPE defined in DOS unit}
  segment  :  WORD;
  vflag    :  BOOLEAN;      {Verify flag TRUE when /V specified}

FUNCTION W2X(w:  WORD):  STRING; {binary word to hex character string}
  CONST HexDigit:  ARRAY[0..15] OF CHAR = '0123456789ABCDEF';
BEGIN                   {similar to REXX standard D2X function}
  W2X :=  HexDigit[Hi(w) SHR 4] + HexDigit[Hi(w) AND $0F] +
          HexDigit[Lo(w) SHR 4] + HexDigit[Lo(w) AND $0F];
END {W2X};  {change in CONST above suggested by Neil J. Rubenking}

PROCEDURE ProcessMCB;                   {Each Memory Control Block}
  VAR                                   {is processed by this PROCEDURE.}
    b        :  CHAR;
    Blocktype:  STRING[12];
    bytes    :  LongInt;
    EnvSize  :  WORD;
    i        :  WORD;
    last     :  CHAR;
    MCBenv   :  ^MemoryControlBlock;
    MCBowner :  ^MemoryControlBlock;
    psp      :  ^ProgramSegmentPrefix;
BEGIN
  IF   (MCB^.BlockTag <> $4D) AND (MCB^.BlockTag <> $5A) AND
       (MCB^.BlockTag <> $00)
  THEN BEGIN
    IF   NullMCB > 0
    THEN WRITELN (NullMCB:6,' contiguous MCBs pointing to empty ',
         'blocks not shown.');
    WRITELN ('Unknown Memory Control Block Tag ''',MCB^.BlockTag,
      '''.');
    WRITELN ('MemMap scan terminated.');
    HALT
  END;
  IF   (MCB^.BlockSize = 0) AND (LastSize = 0)
  THEN INC (NullMCB)  {Count but don't output multiple null MCBs}
  ELSE BEGIN
    LastSize := MCB^.BlockSize;
    IF   NullMCB > 0
    THEN BEGIN
      WRITELN (NullMCB:6,' contiguous MCBs pointing to empty ',
        'blocks not shown.');
      NullMCB := 0
    END
    ELSE BEGIN
      bytes := LongInt(MCB^.BlockSize) SHL 4; {size of MCB in bytes}
      WRITE (W2X(segment):6,W2X(MCB^.BlockSize):8,'0',bytes:9,
        W2X(MCB^.BlockOwner):8,'    ');

      IF   MCB^.BlockOwner = 0
      THEN WRITELN ('Free Space    <unallocated>')
      ELSE BEGIN
        psp := Ptr(MCB^.BlockOwner,0);              {possible PSP}
        {Almost all programs have a tag of $20CD; DOS MODE is one
         that uses $27CD in some versions.}
        IF   (psp^.PSPtag <> $20CD) AND (psp^.PSPtag <> $27CD)
        THEN WRITELN ('System        ', {not valid PSP}
                     '<DOS ',DosVerNum,'.',Hi(DOSVersion),' kernel>')
        ELSE BEGIN                          {valid program segment prefix}
          MCBenv := Ptr(psp^.Environment-1,0);     {MCB of environment}
          BlockType := 'Data        ';             {assume}
          IF   MCB^.Blockowner = (segment + 1)
          THEN BlockType := ProgramBlock
          ELSE
            IF   psp^.Environment = (segment + 1)
            THEN BlockType := EnvironmentBlock;
          WRITE (BlockType:12,'  ');
          IF  MCB^.BlockOwner <> MCBenv^.BlockOwner
          THEN
            IF   DOSVerNum <> 4
            THEN WRITELN ('<unknown>')  {different owner; unknown in 3.X}
            ELSE BEGIN                  {in DOS 4.0 short name is in MCB}
              MCBowner := Ptr(MCB^.Blockowner-1,0);    {MCB of owner block}
              i := 1;
              WHILE (MCBowner^.ProgramName[i] <> #$00) AND (i < 9) DO BEGIN
                WRITE (MCBowner^.ProgramName[i]);
                INC (i)
              END;
              WRITELN
            END
          ELSE BEGIN     {environment must have same owner as MCB}
            IF   DOSVerNum < 3
            THEN WRITELN ('<unknown>')        {DOS 1.X or 2.X}
            ELSE BEGIN                        {DOS 3.X}
              EnvSize := MCBenv^.BlockSize SHL 4;       {multiply by 16}
              i := 0;
              b := CHAR( Mem[psp^.Environment:i] );
              REPEAT
                last := b;    {skip through ASCIIZ environment variables}
                INC (i);
                b := CHAR( Mem[psp^.Environment:i] );
              UNTIL (i > EnvSize) OR ( (b = #$00) AND (last = #$00));
              INC (i);          {end of environment block is $0000}
              b := CHAR( Mem[psp^.Environment:i] );
              IF   (i >= EnvSize) OR (b <> #$01)  {valid signature?}
              THEN WRITE ('<shell>')    {shell is probably COMMAND.COM}
              ELSE BEGIN
                INC (i,2);              {skip process signature $0001}
                b := CHAR( Mem[psp^.Environment:i] );
                REPEAT
                  WRITE (b);            {output process name byte-by-byte}
                  INC (i);
                  b := CHAR( Mem[psp^.Environment:i] )
                UNTIL (i > EnvSize) OR (b = #$00);
              END;
              WRITELN
            END
          END;

          IF   vflag AND (BlockType = EnvironmentBlock)
          THEN BEGIN                        {Display environment variables}
            i := 0;
            b := CHAR( Mem[psp^.Environment:i] );
            WRITELN;
            REPEAT
              IF   b = #$00
              THEN WRITELN                  {end of ASCIIZ string}
              ELSE WRITE (b);
              last := b;
              INC (i);
              b := CHAR( Mem[psp^.Environment:i] );
            UNTIL (i > EnvSize) OR ( (b = #$00) AND (last = #$00));
            WRITELN
          END

        END
      END
    END
  END
END {ProcessMCB};

BEGIN {MemMap}
  DOSVerNum := Lo(DOSVersion);   {major DOS version number, e.g., 3.X}
      {Note:  OS/2 1.1 DOS mode returns 10.10 for major/minor version}

  vflag := (ParamCount > 0) AND
           ((ParamStr(1) = '/v') OR (ParamStr(1) = '/V')) AND
           (DOSVerNum > 2);       {Ignore in DOS 2.X or lower}
  WRITELN ('Memory',' ':41,'MemMap (Version 2, May 89)');
  WRITELN ('Control    Block Size');
  WRITELN (' Block        [Bytes]        Owner');
  WRITELN ('Segment    hex   decimal  Segment      Type      ',
           '                Name');
  WRITELN ('-------  -------  -------  -------  ------------  ',
           '------------------------');
  LastSize := $FFFF;
  NullMCB := 0;

  r.AH := $52;    {undocumented DOS function that returns a pointer}
  Intr ($21,r);   {to the DOS 'list of lists'                       }
  segment := MemW[r.ES:r.BX-2];  {segment address of first MCB found at}
                                 {offset -2 from List of List pointer  }
  REPEAT
    MCB := Ptr(segment,0);       {MCB^ points to first MCB}
    ProcessMCB;                  {Look at each MCB}
    segment := segment + MCB^.Blocksize + 1
  UNTIL (MCB^.Blocktag = $5A)    {last one is $5A; all others are $4D}

END {MemMap}.
```

MEMMAP.PAS: The source code for MEMMAP.EXE, a utility that displays all allocated memory blocks

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PC UTLILITIES BY MODEM

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To download MEMMAP.EXE and its PASCAL or BASIC listing, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename and pick the file you want from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

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Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The new versions are available only from PC MagNet. Here is a partial list of programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
BEN51.EXE (Benchmark tests, Version 5.1)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2 (now works with volumes greater than 32MB)
DIRMATCH.COM, Version 1.1
EMS40.SYS, Version 1.1 (fixes a problem with *Lotus 1-2-3*)
LITES.COM, Version 1.1
LOG.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
RN.COM, Version 2.0 (now works under DOS 4.*x*).
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.2

For a complete listing of all of the programs available from the PC MagNet Utilities Database, download UDCAT.ARC. .

An index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that has the *Computer Library PC Magazine* Reviews Index for January 1988 to June 1989. This easy-to-use database is a subset of the *Computer Library Periodicals Database*, which is available on CD-ROM and PC MagNet. It requires the search files in PCSRCH.EXE.

PCSRCH.EXE is a self-extracting archive with the software used to retrieve citations from the *PC Magazine* Reviews Index. Read PCM.INF before downloading any files. ■

file (stored in a 2,048-byte cluster on most hard disks). While certain efficiencies are lost in a high-level language like Pascal, when writing system utilities the maintainability is often much easier. Besides, it's not difficult to improve on certain DOS components, such as the PC DOS 4.0 MEM command: MEM is a 20,133-byte .EXE file—more than three times as large as the MEMMAP.EXE program. ■

Earl F. Glynn is a Senior Analyst at a large pharmaceutical company based in Kansas City, Kansas.

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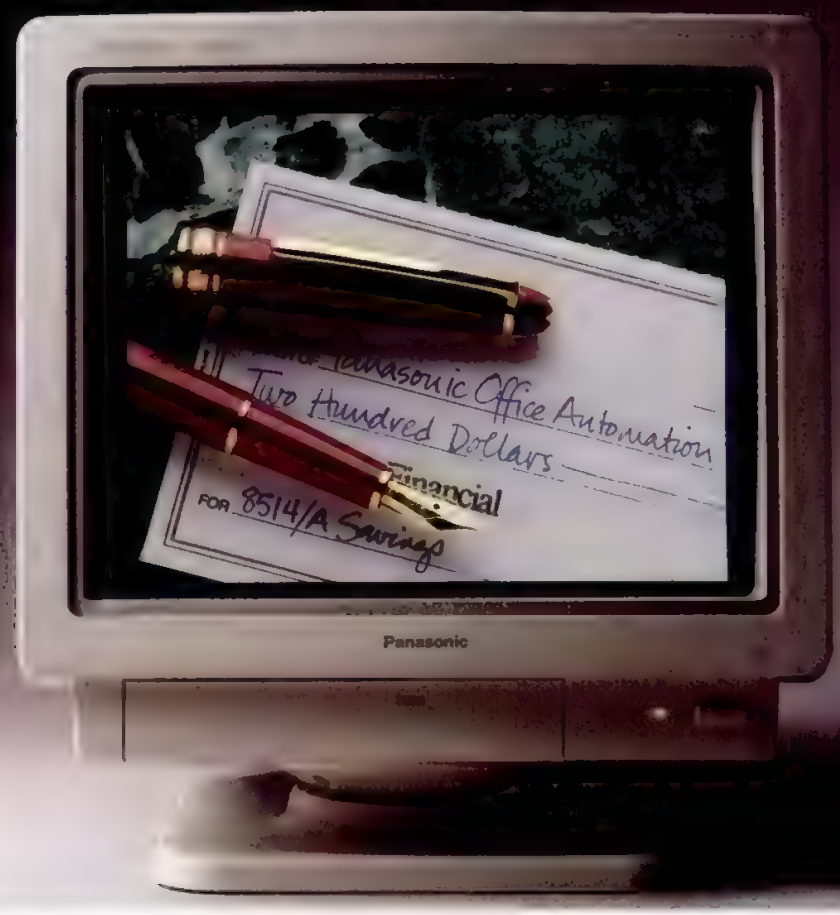

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by
Charles Petzold

Environments

Programming for Multithreaded Drawing, Part 2

■ Programs that draw continuously in a PM window call for a different approach to multithreaded programming.

It's not hard to recognize the need for another thread of execution in a program you're writing for the OS/2 Presentation Manager. When PM programs are doing lengthy processing, they generally tell the user to wait by displaying the infamous hourglass icon. If you see the hourglass frequently or for several seconds at a stretch, then you should consider using multiple threads in your program.

By shifting the lengthy processing task to a second thread that runs concurrently with the program's main thread, you can continue to interact with the program even while it does its other work. This improves the perceived performance of the program.

Multithreaded programming can be difficult, however. The general rule for structuring an OS/2 Presentation Manager program to make use of multiple threads is this: there is no general rule. Each processing problem that seems to require a separate thread must be considered on its own. This is never more true than when the second thread is created for drawing on the program's window.

The THREADS1 program I described in the April 3, 1990, Environments column rendered a complex graphical image on a window by first drawing it on a bitmap. The creation and definition of this bitmap was put in a second thread so that you could continue to interact with the program (and with the rest of PM) while the image was being drawn. The program then displayed the bitmap on its window.

This is a good approach for programs that must display complex graphics that require several seconds (or minutes) for rendering. But the technique may not be appropriate for other types of PM programs.

PROGRAMS THAT RUN FOREVER

You've undoubtedly seen graphics demonstration programs that continuously repeat a simple drawing process. One common example is the random rectangle program that endlessly displays a series of rectangles, each one randomly sized, positioned, and colored.

There are several different approaches to writing such a program for the Presentation Manager. The most common technique uses the PM timer. The program calls the WinStartTimer function to cause the PM to post WM_TIMER messages to the window procedure at set intervals. For each WM_TIMER message, the program displays another rectangle. The RANDRECT program presented in this column in the November 29, 1988, issue of *PC Magazine* did just this.

One problem with this approach, however, is speed. No program can receive WM_TIMER messages more frequently than once every 31.25 milliseconds (1/32 second), the interval OS/2 uses for the system clock.

A second approach is based on the use of the WinPeekMsg function. Here's how it works.

A PM program normally retrieves messages from its message queue by calling WinGetMsg. If the message queue is empty, the WinGetMsg function does not return until a new message is placed in the queue. However, a program can call WinPeekMsg rather than WinGetMsg, and WinPeekMsg returns regardless of whether a message is present or not. If WinPeekMsg retrieves a message, the message can be dispatched as normal. If there is no message in the queue, the program can display another random rectangle.

While useful in some applications, the approach based on using WinPeekMsg is not a good general solution, because the program must frequently call WinPeekMsg while drawing.

A third approach to writing a graphics demonstration program that runs continuously is moving the drawing into a second thread. The main thread handles interaction with the user while the second thread does the drawing. This is the approach I'll be demonstrating here.

STRANGE PATTERNS FROM LINES

The THREADS2 program I'll discuss in this column doesn't draw rectangles, but instead it draws a series of lines using the GPI mix mode known as FM_INVERT. (The FM prefix stands for *foreground mix*.) When the FM_INVERT mix mode is set, GPI draws the lines by inverting the color of the drawing surface. For example, a line drawn on a white surface using FM_INVERT is colored black; on a black surface, the line is white; on a dark red surface, its color is light cyan.

THREADS2 first draws a series of lines, each of which begins at the lower-left corner of the window. The lines end at every possible pixel position on the top and right sides of the window, starting with the upper-left-hand corner and proceeding clockwise to the lower-right corner. The program then draws lines that begin at the

lower-right corner and end at all possible pixel positions on the left and top sides of the window. The next set of lines are drawn from the upper-right corner to the bottom and left sides, and the fourth set run from the upper-left corner to the right and bottom sides. This completes one cycle, and the cycle is then repeated continuously. When THREADS2 goes through the cycle twice, the window is erased, since each pixel has been inverted an even number of times.

The interaction between the lines being drawn and the existing surface of the window results in strange, sometimes symmetrical, moiré-like patterns. One such pattern is shown in Figure 1, and the files necessary to create THREADS2.EXE are listed in Figures 2, 3, and 4.

THREADS2.C contains five functions. The `main` function is normal. ClientWndProc is the window procedure for THREADS2's client window, and it processes WM_CREATE, WM_SIZE, WM_PAINT, and WM_DESTROY messages. SecondThread is the function used for the drawing thread. SecondThread calls DrawPattern to draw one cycle of the pattern, which in turn calls a small function at the bottom of THREADS2.C named DrawLine to draw a single line.

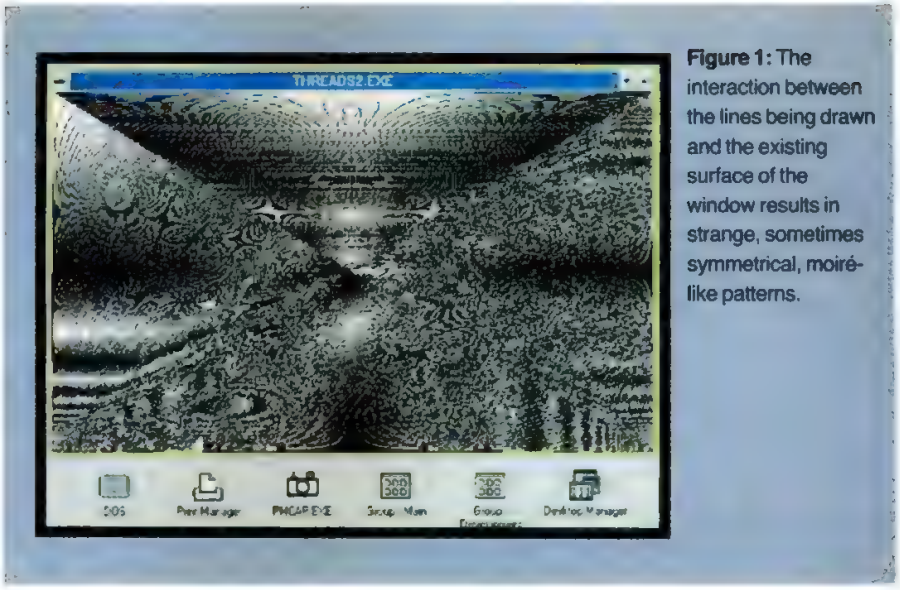

Figure 1: The interaction between the lines being drawn and the existing surface of the window results in strange, sometimes symmetrical, moiré-like patterns.

SHARING VARIABLES

As usual, I've defined a structure near the top of THREADS2.C named THREADPARAMS that contains all the variables that must be shared between the two threads. A structure variable named tp, of type THREADPARAMS, is defined in ClientWndProc.

The first field of this structure is referred to as *hps*, the handle to the presentation space for THREADS2's client window. ClientWndProc creates this presentation space during the WM_CREATE message by calling GpiCreatePS. Customarily, a small Presentation Manager program does not create its own presentation space. Instead, it obtains a precreated "cached" presentation space by calling WinGetPS and (during the WM_PAINT message) WinBeginPaint. However, these cached presentation spaces are for use during the processing of a single message. THREADS2 needs this presentation space for the duration of the program, and that's why it creates its own.

The next two fields of the THREADPARAMS structure are BOOL flags: fContinue and fTerminate. Later on, I'll describe how ClientWndProc uses these two flags to control the second thread. The fContinue flag is set to TRUE whenever the second thread should continue drawing. The fTerminate flag is set to TRUE when the second thread should terminate.

The second two fields found in the THREADPARAMS structure are cxClient and cyClient; they are, respectively, the width and height of THREADS2's client window. ClientWndProc sets these two fields while processing the WM_SIZE message. The drawing thread uses both of these dimensions to draw the pattern on the window.

The last two fields of the THREADPARAMS structure are two RAM semaphores, which are named semTriggerDraw and semDoingDraw. These semaphores provide some coordination and handshaking between the two threads in a manner I'll describe shortly.

A REFRESHER ON SEMAPHORES

Since I haven't used semaphores very frequently in the Presentation Manager programs presented in this column, a brief review may be helpful.

RAM semaphores are simply 32-bit integers stored in static memory. The two threads of THREADS2 make use of two such semaphores for signaling purposes. THREADS2 uses three functions with these RAM semaphores: DosSemSet, DosSemClear, and DosSemWait.

A semaphore used for signaling can be in one of two states: *set* or *clear*. DosSemSet sets a semaphore and DosSemClear clears a semaphore. When a program calls DosSemWait, the function returns immediately if the semaphore is clear, but waits if the semaphore is set. By *wait*, I mean that the function does not return until the semaphore is cleared. The semaphore must be cleared by another thread in the program.

(To be technically accurate, DosSemWait *can* return immediately if the semaphore is set, or it *could* return after a "time-out" period. In THREADS2, however, I use the function with the SEM_INDEFINITE_WAIT parameter. Thus, in this program, DosSemWait *will* always wait until the semaphore is cleared.)

The two threads can control each oth-

THREADS2 — **COMPLETE LISTING**

```
#--------------------
# THREADS2 make file
#--------------------

threads2.obj : threads2.c
     cl -c -Alfw -G2sw -W3 threads2.c

threads2.exe : threads2.obj threads2.def
     link threads2, /align:16, NUL, /nod llibcmt os2, threads2
```

Figure 2: The THREADS2 Make file.

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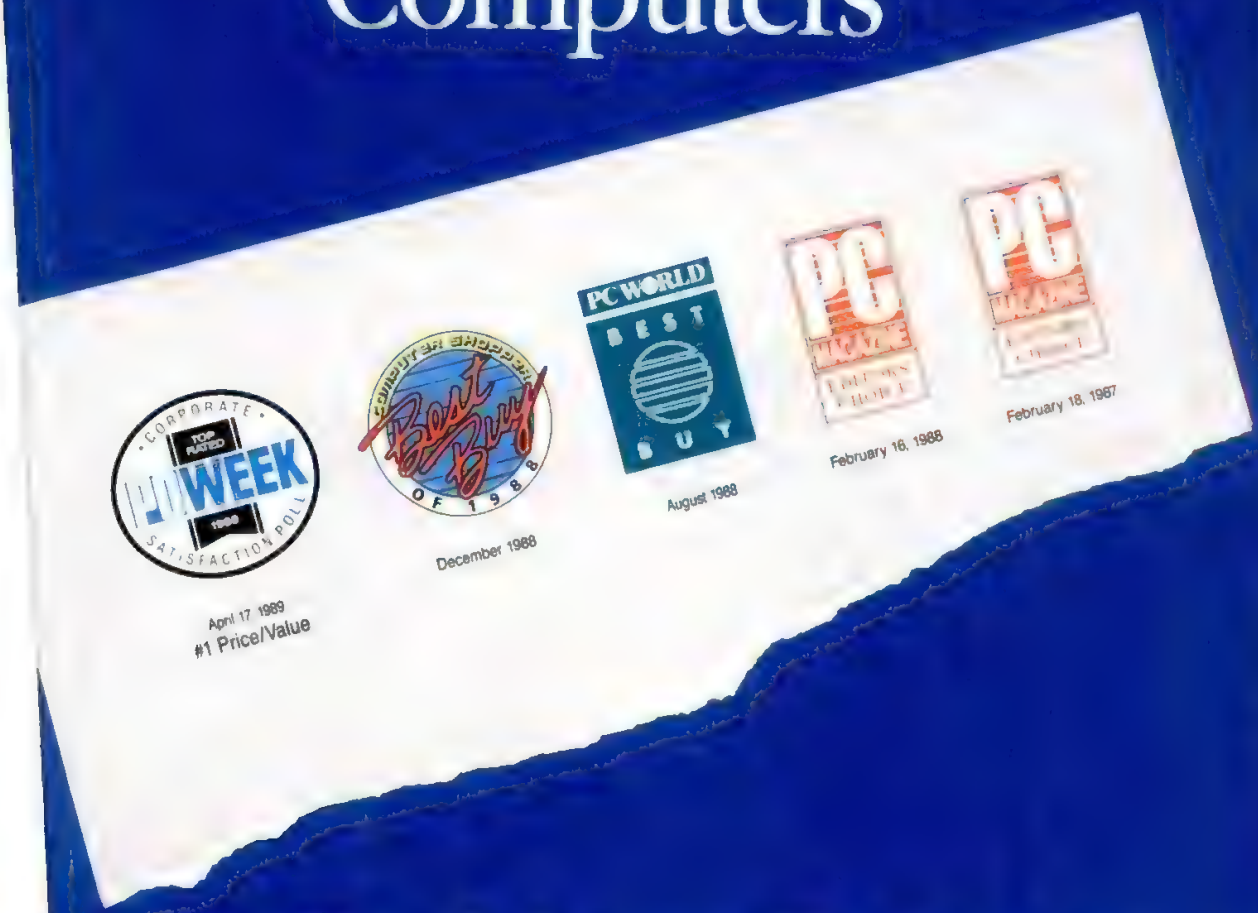

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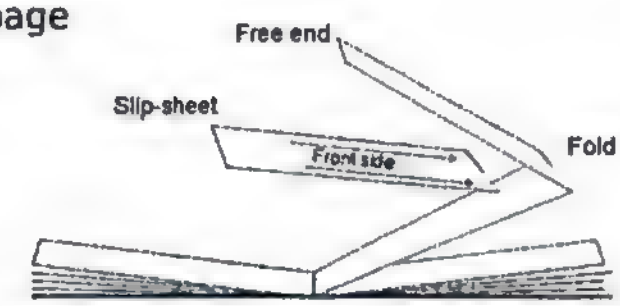

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2. Insert this sheet with
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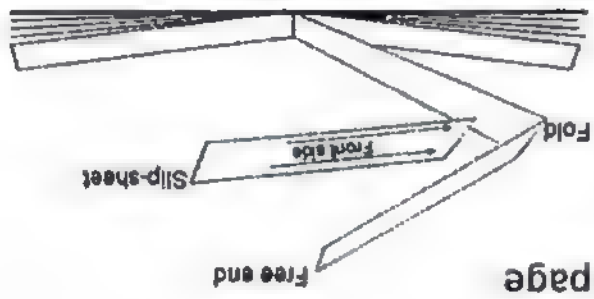
4. Close the page and slip-sheet



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THREADS2.C — COMPLETE LISTING

```
/*-----------------------------------------------------------
   THREADS2.C -- Demonstrates drawing from a second thread
                 (c) 1990, Ziff Communications Co.
                 PC Magazine * Charles Petzold, 1/90
  -----------------------------------------------------------*/

#define INCL_WIN
#define INCL_GPI
#include <os2.h>
#include <mt\process.h>

#define STACKSIZE 4096 * sizeof (int)

typedef struct
     {
     HPS   hps ;
     BOOL  fContinue ;
     BOOL  fTerminate ;
     SHORT cxClient ;
     SHORT cyClient ;
     ULONG semTriggerDraw ;
     ULONG semDoingDraw ;
     }
     THREADPARAMS ;

MRESULT EXPENTRY ClientWndProc (HWND, USHORT, MPARAM, MPARAM) ;
VOID    FAR      SecondThread (THREADPARAMS *) ;
VOID             DrawPattern (HPS, SHORT, SHORT, BOOL *) ;
VOID             DrawLine (HPS, SHORT, SHORT, SHORT, SHORT) ;

HAB  hab ;

int main (void)
     {
     static CHAR  szClientClass [] = "Threads2" ;
     static ULONG flFrameFlags = FCF_TITLEBAR       | FCF_SYSMENU |
                                 FCF_SIZEBORDER     | FCF_MINMAX  |
                                 FCF_SHELLPOSITION  | FCF_TASKLIST ;
     HMQ          hmq ;
     HWND         hwndFrame, hwndClient ;
     QMSG         qmsg ;

     hab = WinInitialize (0) ;
     hmq = WinCreateMsgQueue (hab, 0) ;

     WinRegisterClass (hab, szClientClass, ClientWndProc, CS_SIZEREDRAW, 0) ;

     hwndFrame = WinCreateStdWindow (HWND_DESKTOP, WS_VISIBLE,
                                     &flFrameFlags, szClientClass, NULL,
                                     0L, NULL, 0, &hwndClient) ;

     while (WinGetMsg (hab, &qmsg, NULL, 0, 0))
          WinDispatchMsg (hab, &qmsg) ;

     WinDestroyWindow (hwndFrame) ;
     WinDestroyMsgQueue (hmq) ;
     WinTerminate (hab) ;
     return 0 ;
     }

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     static int          aiThreadStack [STACKSIZE / sizeof (int)] ;
     static THREADPARAMS tp ;
     HDC                 hdc ;
     SIZEL               sizl ;

     switch (msg)
          {
          case WM_CREATE:
                                // create a presentation space for the window

               hdc = WinOpenWindowDC (hwnd) ;
               sizl.cx = 0 ;
               sizl.cy = 0 ;
               tp.hps = GpiCreatePS (hab, hdc, &sizl,
                                     PU_PELS      | GPIF_DEFAULT |
                                     GPIT_MICRO   | GPIA_ASSOC) ;

                                // start the thread after initialization

               tp.fTerminate = FALSE ;

               DosSemSet (&tp.semTriggerDraw) ;
               DosSemClear (&tp.semDoingDraw) ;
               if (_beginthread (SecondThread, aiThreadStack,
                                 STACKSIZE, &tp) == -1)
                    {
                    WinMessageBox (HWND_DESKTOP, hwnd,
                                   "Cannot create second thread!", "Threads2",
                                   0, MB_OK | MB_ICONEXCLAMATION) ;
                    return 0 ;
                    }

               return 0 ;

          case WM_SIZE:
                                // stop the thread from drawing

               tp.fContinue = FALSE ;
               DosSemWait (&tp.semDoingDraw, SEM_INDEFINITE_WAIT) ;

               tp.cxClient = SHORT1FROMMP (mp2) ;
               tp.cyClient = SHORT2FROMMP (mp2) ;
               return 0 ;

          case WM_PAINT:
                                // stop the thread from drawing

               tp.fContinue = FALSE ;
               DosSemWait (&tp.semDoingDraw, SEM_INDEFINITE_WAIT) ;

                                // erase the whole window

               WinInvalidateRect (hwnd, NULL, FALSE) ;

               WinBeginPaint (hwnd, tp.hps, NULL) ;
               GpiErase (tp.hps) ;
               WinEndPaint (tp.hps) ;

                                // let the thread start again at the beginning

               tp.fContinue = TRUE ;
               DosSemSet (&tp.semDoingDraw) ;
               DosSemClear (&tp.semTriggerDraw) ;
               return 0 ;

          case WM_DESTROY:
                                // stop the thread and clean up

               tp.fTerminate = TRUE ;
               tp.fContinue  = FALSE ;
               DosSemWait (&tp.semDoingDraw, SEM_INDEFINITE_WAIT) ;

               GpiDestroyPS (tp.hps) ;
               return 0 ;
          }
     return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }

VOID _CDECL FAR SecondThread (THREADPARAMS * ptp)
     {
     HAB  hab ;

     hab = WinInitialize (0) ;

     while (!ptp->fTerminate)
          {
                                // wait for the semaphore to be cleared

          DosSemWait (&ptp->semTriggerDraw, SEM_INDEFINITE_WAIT) ;

                                // draw the pattern until stopped

          while (ptp->fContinue)
               DrawPattern (ptp->hps, ptp->cxClient,
                                      ptp->cyClient, &ptp->fContinue) ;

          DosSemSet (&ptp->semTriggerDraw) ;
          DosSemClear (&ptp->semDoingDraw) ;
          }

     WinTerminate (hab) ;
     _endthread () ;
     }

VOID DrawPattern (HPS hps, SHORT cxClient, SHORT cyClient, BOOL *pfContinue)
     {
     SHORT x, y ;

     GpiSetMix (hps, FM_INVERT) ;
     for (x = 0 ; *pfContinue && x < cxClient ; x++)
          DrawLine (hps, 0, 0, x, cyClient) ;

     for (y = cyClient ; *pfContinue && y > 0 ; y--)
          DrawLine (hps, 0, 0, cxClient, y) ;

     for (y = 0 ; *pfContinue && y < cyClient ; y++)
          DrawLine (hps, cxClient, 0, 0, y) ;

     for (x = 0 ; *pfContinue && x < cxClient ; x++)
          DrawLine (hps, cxClient, 0, x, cyClient) ;

     for (x = cxClient ; *pfContinue && x > 0 ; x--)
          DrawLine (hps, cxClient, cyClient, x, 0) ;

     for (y = 0 ; *pfContinue && y < cyClient ; y++)
          DrawLine (hps, cxClient, cyClient, 0, y) ;

     for (y = cyClient ; *pfContinue && y > 0 ; y--)
          DrawLine (hps, 0, cyClient, cxClient, y) ;

     for (x = cxClient ; *pfContinue && x > 0 ; x--)
          DrawLine (hps, 0, cyClient, x, 0) ;
     }

VOID DrawLine (HPS hps, SHORT x1, SHORT y1, SHORT x2, SHORT y2)
     {
     POINTL ptl ;

     ptl.x = x1 ; ptl.y = y1 ; GpiMove (hps, &ptl) ;
     ptl.x = x2 ; ptl.y = y2 ; GpiLine (hps, &ptl) ;
     }
```

Figure 3: The THREADS2.C source code file.

ers' actions by setting and clearing semaphores. When one thread calls DosSemWait on a set semaphore, the thread is blocked until another thread is ready for it to proceed. It signals the next thread by calling DosSemClear to clear the semaphore.

In THREADS2, the semDoingDraw semaphore is set whenever the second thread is drawing. The primary thread will wait for this semaphore to be cleared before doing anything that could interfere with the drawing. The semTriggerDraw semaphore is used by the primary thread to signal the drawing thread. The drawing

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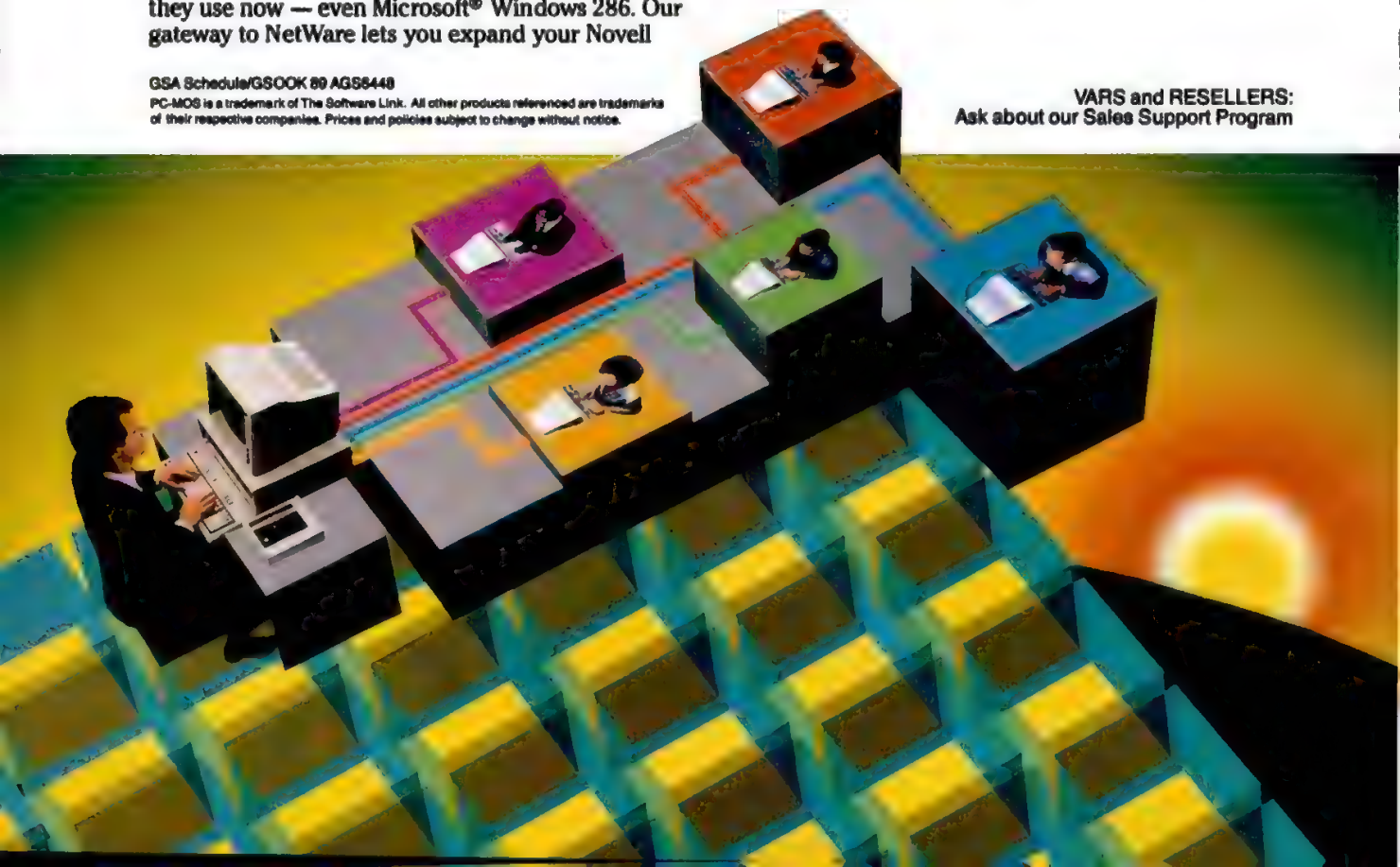

thread waits for this semaphore before drawing. The primary thread can tell the drawing thread when to begin drawing by clearing the semaphore.

RESTRICTIONS ON THREAD DRAWING

Why do we need all this coordination and handshaking between the two threads? Part of the problem is that the image drawn by the second thread is dependent on the size of the client window. If the size of the client window changes, ClientWndProc should stop the drawing thread, set the new window size, and then recommence the drawing.

Further, there is a restriction on how two threads may use a single presentation space. If one thread is currently making a GPI function call for a particular presentation space, another thread cannot make the same or another GPI function call for the same presentation space. If the program attempts to do so, the second GPI function call will fail with an error condition. If the program then calls WinGetError, it will find an error code of 0x20F4, which has an identifier named PMERR_PS_BUSY. This means that the presentation space is busy because another GPI function is doing something with it.

This restriction does not mean that the GPI functions are not reentrant. Multiple programs and multiple threads may call GPI functions whenever they want, just as long as each call involves a different presentation space. But two threads (or two processes) may not make GPI function calls for the same presentation space at the same time.

This prohibition may or may not seem sensible to you, but it's the way it is. If you need to call GPI using the same presentation space from two or more threads, you must be careful to synchronize the threads so they do not call GPI at the same time.

Actually, there is one exception to the prohibition. It's a function called GpiSetStopDraw, and its specific purpose is to allow one thread to control drawing by another thread. I'll discuss this function in next issue's column.

CREATING THE THREAD

Returning to THREADS2.C, when ClientWndProc receives a WM_CREATE message, it begins by creating a presentation space for the window. The handle is saved in the hps field of the THREADPARAMS structure.

ClientWndProc then initializes several fields of the THREADPARAMS structure. It sets fTerminate to FALSE (this variable will remain set to FALSE until the WM_DESTROY message). It also sets the semTriggerDraw semaphore by calling DosSemSet, and it clears the semDoingDraw semaphore by calling DosSemClear. A call to _beginthread starts the second thread (the function SecondThread), which receives as a parameter a pointer to the THREADPARAMS structure.

The second thread begins execution as usual by calling WinInitialize. SecondThread then enters a `while` loop, where it will remain until the fTerminate field of the THREADPARAMS structure is set to TRUE.

The first function that SecondThread calls within this `while` loop is DosSem-

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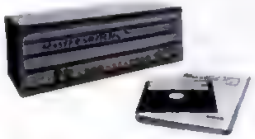

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THREADS2.DEF COMPLETE LISTING

```
;-------------------------------------
; THREADS2.DEF module definition file
;-------------------------------------

NAME            THREADS2  WINDOWAPI

DESCRIPTION     'Second Thread Drawing Demo (c) 1990, Ziff Communications Co.'
PROTMODE
HEAPSIZE        1024
STACKSIZE       8192
EXPORTS         ClientWndProc
```

Figure 4: The THREADS2.DEF module-definition file.

Wait. SecondThread stops here, waiting for the semTriggerDraw semaphore (set during the WM_CREATE message in ClientWndProc) to be cleared. The thread should not commence drawing yet because the size of the client window is not yet known.

THE FIRST SIZE AND PAINT MESSAGES

ClientWndProc receives a WM_SIZE message whenever the size of the client window changes. It receives its first WM_SIZE message shortly after the WM_CREATE message. Let's examine what happens at that point.

ClientWndProc begins processing the WM_SIZE message by setting the fContinue field in the THREADPARAMS structure to FALSE. This has no effect for the *first* WM_SIZE message, but it's important for subsequent WM_SIZE messages. ClientWndProc also calls DosSemWait to wait for the semDoingDraw semaphore to be cleared. Since that semaphore was already cleared in the WM_CREATE message, however, this statement has no current effect either.

The WM_SIZE processing concludes by setting the cxClient and cyClient fields of the THREADPARAMS structure to the width and height of the client window.

The first WM_SIZE message is followed by the first WM_PAINT message. WM_PAINT processing begins with the same two statements as WM_SIZE. As is the case with the first WM_SIZE message, these statements have no effect during the first WM_PAINT message.

WM_PAINT processing continues with calls to WinBeginPaint, GpiErase, and WinEndPaint, to erase the entire window. (This code is preceded by a call to WinInvalidateRect to ensure that the whole window is invalidated and hence erased.)

ClientWndProc then sets fContinue to TRUE, calls DosSemSet to set the semDoingDraw semaphore, and DosSemClear to clear the semTriggerDraw semaphore.

The semTriggerDraw semaphore is now clear. This is the event that SecondThread has been waiting for! When we last left SecondThread, it was sitting patiently in a DosSemWait call, waiting for the semTriggerDraw semaphore to be cleared. Now that's been cleared, so the DosSemWait call returns. The fContinue flag has been set to TRUE, so SecondThread calls DrawPattern. The parameters to DrawPattern are the presentation space handle, the width and height of the client window, and a pointer to the fContinue field of the THREADPARAMS structure.

DrawPattern draws one cycle of lines, using eight `for` loops. Notice that each `for` loop checks the fContinue flag before drawing each line. When the flag is set to FALSE, DrawPattern will quickly drop out of the `for` loops and return control to SecondThread.

SUBSEQUENT SIZE AND PAINT MESSAGES

Whenever the size of THREADS2's client window changes, the window procedure should stop the drawing in the second thread, save the new width and height of the window in the THREADPARAMS structure, and then start the thread drawing again from the beginning.

When ClientWndProc receives a WM_SIZE message, it sets fContinue to FALSE and then calls DosSemWait to wait for the semDoingDraw semaphore to be cleared. (Recall that the semaphore was set at the end of the WM_PAINT message to indicate that the second thread is currently drawing.) Because the cxClient and cyClient fields of the THREADPARAMS structure are passed to DrawPattern, processing of the WM_SIZE message—which involves setting these fields to new values—should not continue until the second thread has stopped drawing.

Because the fContinue flag has been set to FALSE, DrawPattern returns control to SecondThread, which then calls DosSemSet to set the semTriggerDraw semaphore and DosSemClear to clear the semDoingDraw. At the top of the `while` loop, SecondThread then calls DosSemWait to wait for semTriggerDraw (which it just set) to be cleared.

Because semDoingDraw has now been cleared, processing of the WM_SIZE message can continue. It sets the cxClient and cyClient structure fields to the new width and height of the client window.

The WM_SIZE message is followed shortly by a WM_PAINT message. This is because the window class for the client window was registered in `main` with a style of CS_SIZEREDRAW. This ensures that a WM_PAINT message will follow every WM_SIZE message.

WM_PAINT processing begins by setting fContinue to FALSE (this currently has no effect), and it then calls DosSemWait to wait for semDoingDraw to be cleared (again with no immediate effect). The window procedure then erases the window.

WM_PAINT processing concludes by setting fContinue to TRUE, calling DosSemSet to set semDoingDraw and DosSemClear to clear semTriggerDraw. SecondThread (which has been waiting for semTriggerDraw to be cleared) commences as before, starting the cycle from the beginning on an erased window. The window resizing operation has been completed.

It is also possible for ClientWndProc to receive a WM_PAINT message caused by something other than a window resizing. In this case, ClientWndProc sets fContinue to FALSE (which stops the drawing from the second thread) and then waits for semDoingDraw to be cleared, exactly as in the case of a WM_SIZE message. WM_PAINT processing then proceeds as described above—the entire window is erased and the drawing starts from the beginning of the cycle.

THE END GAME

When the program is terminating, ClientWndProc gets a WM_DESTROY message. In response, it sets fTerminate to TRUE, fContinue to FALSE, and waits for the semDoingDraw semaphore to be cleared. Except for setting the fTerminate flag to TRUE, the code is the same as that used at the start of the WM_SIZE and WM_PAINT messages.

In response to the fContinue flag being set to FALSE, SecondThread stops drawing and clears the semDoingDraw flag. This allows WM_DESTROY processing to continue. The presentation space is destroyed with a call to GpiDestroyPS. SecondThread drops out of the `while` loop and terminates.

THE WINDOW MOVE

If the window procedure gets a WM_SIZE or WM_PAINT message, THREADS2 erases the entire window and starts the drawing from the beginning. This seems reasonable for such a program.

But the window is also erased and drawing starts over if you *move* the window. This is somewhat unusual. Normally, if you move a window, the window procedure does not receive a WM_PAINT message. PM simply copies the pixels of the window from the old area of the screen occupied by the window to the new area of the screen. Yet there's a reason why THREADS2 behaves differently.

During a move or size operation, PM displays a frame that indicates the new position or size of the window. While this frame is displayed, PM inhibits all drawing on the screen, because the frame could interfere with window drawing. The GPI calls aren't blocked—the Presentation Manager allows them through—but they don't render anything on the screen.

After the move or size operation is complete, PM will invalidate the smallest possible rectangular area within any window on which an attempt is made to draw while the frame is visible on the screen. The second thread of THREADS2 is making GPI function calls during the whole duration of a move operation, so it receives a WM_PAINT message after the move is complete.

THE NEXT INSTALLMENT

Earlier, I mentioned a GPI function called GpiSetStopDraw. As I indicated, this is the only GPI function that has a presentation space handle as the first parameter but can be called without error while another GPI function call using that same presentation space is in progress.

In the next issue, we'll examine this interesting function and see how it is specifically designed to control drawing in a second thread of execution. ■

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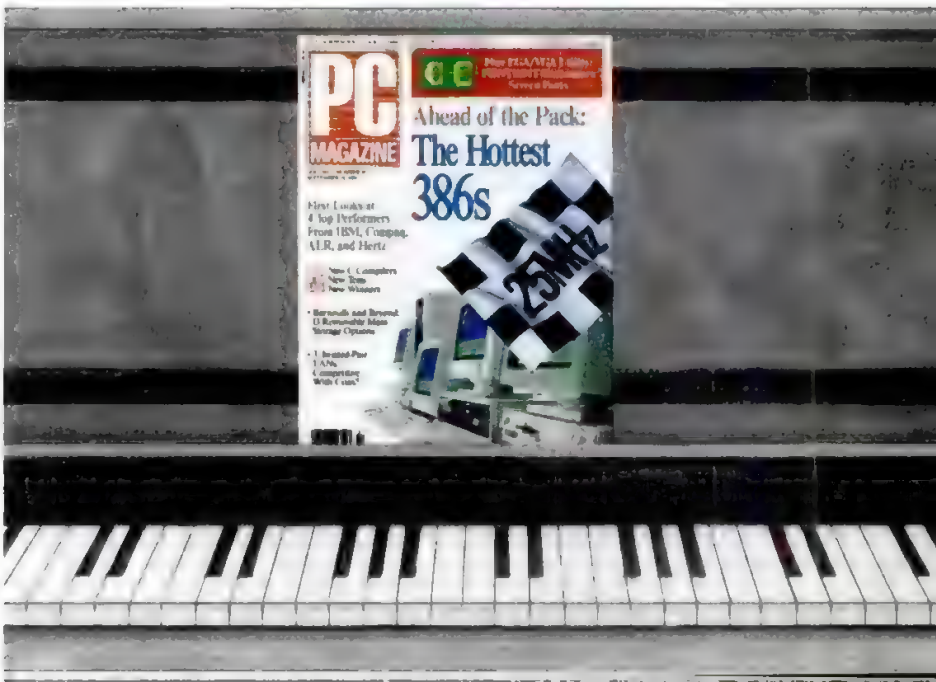

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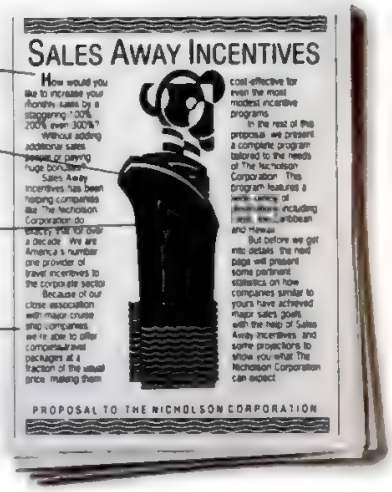

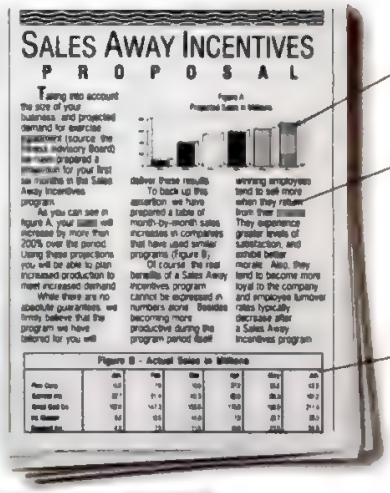

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by
Ray Duncan

Power Programming

Explore the Depths And Impact of OS/2's New 32-bit API

OS/2 2.0, the new 80386-specific 32-bit version of OS/2, supports no less than three distinct Application Program Interfaces (APIs). One is the real-mode, DOS- and ROM BIOS–compatible API, which is reached via software interrupts by programs running in the DOS boxes. The second is the 16-bit protected-mode API, which is essentially identical to the API found in OS/2 1.2. Third, of course, is the 32-bit protected-mode API itself.

You might think of the new operating system as an immense package of functionality that wears one of three different wrappers, according to the type of application program that is running. OS/2 2.0 brings to mind Gordon Bell's characterization of many modern CPUs as "code museums," where the vestiges of many other CPUs whose era has passed can be seen in their instruction sets. In OS/2 2.0, we have the first instance of an operating system museum!

The 32-bit API deserves especially close examination, because it is more than the simple translation of the 16-bit API many of us had expected, and because it gives us some clues about Microsoft's and IBM's future plans.

At the most fundamental level, the 32-bit API employs a substantially different method of passing parameters than does the 16-bit API. Figures 1, 2, and 3 will help clarify the differences. The 16-bit API relies on a *far pascal* calling convention, in which parameters are pushed on the stack from left to right and the called routine is responsible for clearing the arguments from the stack. (OS/2 1.*x* inherited the use of this calling convention from *Microsoft Windows*, which originally adopted it solely because it saved a few hundred bytes of systemwide memory.) The 32-bit API uses a *cdecl* calling convention, in which parameters are pushed right to left and the caller clears the stack.

To be sure, the difference in parameter passing methods between the 16-bit and 32-bit APIs is the business of your compiler and linker; it is not ordinarily visible to the programmer. But it has a number of other, somewhat ominous implications. Conversion to *cdecl* makes the 32-bit API look very much like an extension of the C runtime library. This may be a happy situation for vendors of C compilers, but it is destined to cause increasing confusion and aggravation for everyone else in the programming tools business. Existing versions of Unix demonstrate the inevitable end point of this process all too clearly: in Unix you can't really tell where the C runtime library (RTL) ends and the operating system starts; porting a high-level language to Unix, which is not written in C, is sheer torture; and you often find the Unix kernel meddling in things that are properly the business of the runtime library (and vice versa).

■ Many of the changes in the 32-bit API kernel show a distinct shift toward C and away from assembly language programming.

HELLO.C COMPLETE LISTING

```
/*
     hello.c, using direct call to DosWrite
*/
#include <stdio.h>
#define INCL_DOS
#include <os2.h>

main(int argc, char *argv[])
{
     int wlen, rc;
     char *p = "\nHello World!";
     rc = DosWrite(1, p, strlen(p), &wlen);
}
```

Figure 1: This simple "Hello World" program in C was used to generate the example API interface code in Figures 2 and 3.

At the level where the typical C application programmer works, the Presentation Manager and kernel portions of the 16-bit API have met with rather different fates during their conversion to 32-bit protected mode. The 32-bit Presentation Manager API is essentially identical to the 16-bit PM API. A program that calls only PM services and the C RTL requires only the most minor changes before it can be recompiled as a true 32-bit application. This fulfills the implicit promise of portability made by Microsoft's and IBM's PM header files, with all their multiple layers of macros, typedefs, and structures, and the horrendous toll they exact in compilation time.

The 32-bit kernel API is another story: many functions have been renamed while retaining essentially the same functionality; many new functions have appeared on the scene; and many old functions have disappeared for good. The intent of almost all of these changes is to rationalize the API and to make code more portable (eventually) to 32-bit versions of OS/2 that run on other processors.

The near-term impact of all these changes is distressing, however. In every version of OS/2 to date there have been significant shifts in the kernel API. This has meant that programmers who have called kernel functions directly from their programs in order to get the most out of the operating system have been forced to rethink and rewrite sizable chunks of their

HELLO286 COMPLETE LISTING

```
        .286p
        .287
        assume  cs:_TEXT, ds:DGROUP, ss:DGROUP

_DATA   segment
msg     db      0ah,'Hello World!',0    ; text to display
_DATA   ends

_TEXT   segment
wlen    equ     word ptr [bp-6] ; assign stack locations
rc      equ     word ptr [bp-4] ; of local variables
p       equ     word ptr [bp-2]

_main   proc    near
        push    bp              ; set up stack frame
        mov     bp,sp
        mov     ax,6            ; allocate local vars
        call    __chkstk
        mov     p,offset DGROUP:msg ; initialize p pointer
                                ; set up DosWrite call
        push    1               ; push stdout handle
        push    ds              ; push far pointer to text
        push    offset DGROUP:msg
        push    offset DGROUP:msg
        call    _strlen
        add     sp,2
        push    ax              ; push length of text
        lea     ax,wlen         ; push far pointer to wlen
        push    ss
        push    ax
        call    far ptr DosWrite   ; transfer to OS/2
        mov     rc,ax           ; save error/success code
        leave                   ; discard stack frame
        ret                     ; return to caller
_main   endp

_TEXT   ends
```

Figure 2: These machine instructions are generated by the 16-bit C compiler for a direct call to a kernel API function, from the source code in Figure 1. The code has been edited and commented for readability. The 16-bit API uses the *far pascal* calling convention, in which the parameters are pushed left to right and the called routine clears the stack. Notice that the compiler has optimized away certain memory references by "remembering" that the p variable contains the address of msg.

code—whether or not they used the Microsoft and IBM header files and abided strictly by Microsoft's and IBM's coding conventions and recommendations. OS/2 2.0 continues this ungracious tradition, rewarding even those programmers who have played by the rules with yet another major conversion effort.

RENAMED API FUNCTIONS

For those 32-bit API functions that have been renamed but have remained functionally the same as their 16-bit counterparts, the renamings have generally aimed at rationalizing the API name space by putting all names into a more "predictable" form. For example, the 16-bit API contains a hodgepodge of names of the form Dos*Getxxx*, *DosQxxx*, and *DosQueryxxx*. In the 32-bit API, essentially all of the calls that obtain information from the operating system but don't allocate some sort of resource have names of the form DosQuery*xxx*. Names have also been changed where necessary to put them into a "verb object" format symmetric with the PM API. For example, DosCWait became DosWaitChild, DosBufReset became DosResetBuffer, and DosFileLocks became DosSetFileLocks. The most important kernel renamings are summarized in Figure 4.

The extent of the renaming in OS/2 2.0 is actually more pervasive than I have made it appear. The entry points for all of the 32-bit API functions have been given names of the form Dos32*xxx*. This allows distinguishing between the 16-bit and 32-bit entry points for those functions that have otherwise identical names, so a 16-bit protected-mode program can selectively call 32-bit entry points and a 32- bit protected-mode program can call 16-bit entry points. When a 32-bit program is being compiled under more normal circumstances, however, all of these Dos32*xxx* names are aliased in the header files to the form Dos*xxx*. Thus the programmer need not be concerned with the existence of the Dos32*xxx* names at all.

VANISHED API FUNCTIONS

Almost all the kernel functions that have disappeared in the 32-bit API are those that had implicit or explicit machine dependencies. These range from calls like DosSetVec (an API equivalent of poking an 80*x*86 interrupt vector) to DosCLIAccess, DosPortAccess, DosCallBack, and DosR2StackRealloc (all of which were related to the 80*x*86 architecture's ring scheme of privilege levels) to DosGetInfoSeg (which returned selectors for two 16-bit protected mode segments). The information a program could previously extract from the global or local information segments must now be obtained by explicit calls to such functions as DosGetDateTime, DosQuerySysInfo, and the new function DosGetThreadInfo. The 16-bit Dos*xxx* functions that have gone away are listed in Figure 5.

In addition to these, the entire battery of Vio*xxx*, Kbd*xxx*, Mou*xxx*, and DosMon*xxx* calls is not supported by the 32-bit API. Although the 16-bit entry points for these calls are still available—and in fact, can be called by 32-bit programs—it is clearly Microsoft's and IBM's intention to divide 32-bit applications into two and only two categories: marginally interactive, character-oriented programs (such as the C compiler), which perform their input and output by DosRead and DosWrite of the standard device handles; and true Presentation Manager applications, which obtain their inputs through a window message queue and perform all their output by painting in a window. The ultimate objective here is no doubt a good one: to bludgeon all applications into using GUI, thus benefiting the end user. Still, it's a little sad to see the rather elegant VIO subsystem discarded completely (regardless of its close linkage to the design of PC video adapters). And now I can't understand why the AVIO functions were introduced in the first place.

In any event, the omission of the Vio*xxx*, *Mouxxx*, and Kbd*xxx* functions in the 32-bit API certainly sounds the death knell for assembly language programming under OS/2. The creation of PM applications in assembly language is clearly impractical, and there is little justification for writing character-oriented programs in MASM for performance reasons if control of the screen is limited to ANSI escape sequences.

HELLO386 COMPLETE LISTING

```
        .386
        assume  cs:FLAT,ds:FLAT,es:FLAT,ss:FLAT

_DATA   segment dword use32 public 'CODE'
msg     db      0ah,'Hello World!',0    ; text to display
_DATA   ends

_TEXT   segment dword use32 public 'CODE'
wlen    equ     dword ptr [bp-12]  ; assign stack locations
rc      equ     dword ptr [bp-8]   ; of local variables
p       equ     dword ptr [bp-4]

_main   proc    near
        push    ebp                ; set up stack frame

        mov     ebp,esp
        sub     esp,12             ; allocate local vars
        mov     p,offset msg       ; initialize variable p
                                   ; set up Dos32Write call
        lea     eax,wlen           ; push address of wlen
        push    eax
        push    offset msg         ; find length of text
        call    _strlen
        lea     esp,dword ptr [ebp-16]  ; clear stack
        push    eax                ; push length of text
        push    p                  ; push address of text
        push    1                  ; push stdout handle
        call    Dos32Write         ; transfer to OS/2
        lea     esp,wlen           ; clear args from stack
        mov     rc,eax             ; save error/success code
        leave                      ; discard stack frame
        ret                        ; return to caller
_main   endp

_TEXT   ends
```

Figure 3: These are the machine instructions generated by the 32-bit C compiler for a direct call to a kernel API function, again using the source code in Figure 1. The code has been edited and commented for readability. The reference to DosWrite in the source code has been automatically translated to the name of the actual 32-bit entry point, Dos32Write, by #define statements in the header files. Note that the 32-bit API uses the *cdecl* calling convention, in which parameters are pushed right to left and the caller clears the stack.

NEW AND CHANGED API FUNCTIONS

The most drastic alterations in the API are in the areas of file management, thread management, memory allocation, semaphores, signals, and exception handling.

The "new" 32-bit file API is not really new at all. It will not cause any problems for those few programmers who have already converted their applications to handle the long filenames and extended attributes supported by OS/2 1.2, because the 32-bit DosOpen, DosFindFirst, and DosCreateDir of OS/2 2.0 are exactly symmetric to the DosOpen2, DosFindFirst2, and DosMkDir2 of OS/2 1.2. (See Power Programming, March 27, 1990, through May 15, 1990, for further information on these functions.) However, because of the rather narrow time window that existed for the OS/2 1.2 conversion (the retail OS/2 1.2 Programmer's Toolkit actually reached dealers *after* the OS/2 2.0 SDK started shipping), adapting to the 32-bit file API will still be a live issue for most software developers.

The 32-bit multitasking API is nominally the same as the 16-bit API with regard to control of sessions and processes, but the thread-related functions have been significantly improved. Stack space for new threads is allocated automatically during DosCreateThread, and it is reclaimed automatically when the thread terminates. There is a new function, DosWaitThread, that allows one thread to wait for any other thread to die. This is analogous to the action of DosWaitChild (formerly DosCWait) for processes. However, the much-needed DosKillThread API is *still* missing! Information on a per-thread basis is no longer obtained from the local information segment, which no longer exists for pure 32-bit applications; instead, a program must call the new DosGetThreadInfo function. This function returns a structure that contains (among other things): the current process ID, the current process's parent ID, the module handle, command-line pointer, environment pointer, current thread ID, current thread priority, thread stack size and base, and a pointer to the thread's exception handler chain.

The memory management API for OS/2 2.0 will take some study, but it is not difficult to master. Once you accept the transition from allocation of memory *segments* to allocation of memory *objects*, you will feel yourself back on familiar ground. The DosAllocSeg and DosAllocHuge functions have been merged into a single DosAllocMem function; DosFreeSeg has become DosFreeMem; DosGetSeg has become DosGetSharedMem; DosGiveSeg has become DosGiveSharedMem; and so on. The DosSubxxx functions are intact, and a new DosSubUnset function has been added. Programmers may even find these functions useful, now that they can be employed for managing local heaps!

There are, nevertheless, several important new concepts in OS/2 2.0 memory management. All memory allocations by the system are delivered rounded up to the next multiple of 4K (the 80386 page size). When you allocate a memory object, you also specify its access rights: execute, read-only, read-write, or guard (more about this in the next issue). Finally, a crucial distinction is drawn between memory object *allocation* and *commitment*. Allocation reserves a range of addresses for a memory object but does not in itself make those addresses accessable. Commitment reserves physical memory and/or swap file space for part or all of a memory object, causing the addresses within the committed pages to become valid.

One perhaps unexpected result of the allocation/commitment paradigm, along with the flat memory model for 32-bit applications, is that DosReallocSeg and DosReallocHuge have no equivalent in the 32-bit API. When you allocate an object, you are supposed to make it large enough for its worst-case requirements, then call DosSetMem to commit increasingly large portions of the object only when you need them. Alternatively, when data outgrows its memory object, you can allocate and commit a new, larger object, copy the data from the old to the new object, then release the original memory object. We'll be looking at OS/2 2.0 memory management in much more detail in forthcoming columns.

The 16-bit semaphore API has been completely replaced by a new, very complex 32-bit semaphore API. The latter supports three newly defined species of semaphores: mutex semaphores, event semaphores, and multiple-wait sema-

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phores. The new scheme eliminates some of the ambiguities, as well as the notorious limits on the number of system semaphores, of the 16-bit version of OS/2. In particular, there is no longer a distinction between *RAM Semaphores* (which cannot be cleaned up by the system) and *System Semaphores*; all semaphores are now under the control of the system, although the process can choose to make some semaphores "anonymous" so that other processes can't get access to them.

As you might expect, there are three symmetric sets of API functions (a total of about 20 different functions) that operate on the three new semaphore types: DosCreateEventSem, DosCreateMutexSem, DosCreateMuxWaitSem, and so on. The data structures for the semaphore types are not compatible in any way with the RAM semaphores, system semaphores, and Fast-Safe-RAM semaphores supported by the 16-bit API, so a 16-bit application and 32-bit application cannot communicate using semaphores unless they perform cross-mode API calls. I'm sure the changes in the semaphore API are for the better, but I do wish that the semaphore API had ended up looking a bit more unified, compact, and straightforward. The code burden that OS/2 2.0 must carry around in order to support both the 16-bit semaphore API and the 32-bit API is enough to make you shudder.

While the changes in the semaphore API might make you apprehensive, however, most of the remaining interprocess communications functions are essentially untouched. The 32-bit API for anonymous pipes, named pipes, named shared segments, and queues is essentially identical to the 16-bit API (allowing, of course, for the substitution of 32-bit offsets for selector:offset pairs and some renamings). However, *signals* as we knew them in OS/2 1.*x* have essentially disappeared. And rightly so: the signals in OS/2 1.*x* were only bizarre relics of Unix anyway! Instead, signal and exception handling have been regularized and unified, and the 16-bit signal (DosSetSigHandler, DosHoldSignal, DosSendSignal, DosFlagProcess) and exception handling (DosSetVec) functions have been entirely replaced by four new 32-bit functions: DosRaiseException, DosSetExceptionHandler, DosUnsetExceptionHandler, and DosUnwindException.

We'll discuss exception handling more thoroughly in a subsequent column, but there are two interesting points to touch on now. First, OS/2 2.0 contains a built-in floating-point emulator that automatically services "coprocessor not found" exceptions on a per-thread basis. Consequently, there is no longer a need for compilers to have separate software and hardware floating-point runtime libraries. All programs can be compiled with in-line coprocessor instructions, and if a program is executed on a machine without a floating-point coprocessor, the emulation library in the kernel will intercede and carry out the floating-point operations in a manner invisible to the application.

Second, 32-bit applications can register an exception handler for GP faults. This is a powerful feature that will make life a whole lot simpler for people like me, who write interpreters and incremental compilers—not to mention easing the jobs of developers of editors, spreadsheets, and other applications that are programmable in macro languages.

RENAMED OS/2 2.0 FUNCTIONS

16-bit API	32-bit API
DosBufReset	DosResetBuffer
DosChDir	DosSetCurrentDir
DosChgFilePtr	DosSetFilePtr
DosCWait	DosWaitChild
DosFileLocks	DosSetFileLocks
DosGetCollate	DosQueryCollate
DosGetCp	DosQueryCp
DosGetCtryInfo	DosQueryCtryInfo
DosGetDBCSEv	DosQueryDBCSEnv
DosGetModHandle	DosQueryModuleHandle
DosGetModName	DosQueryModuleName
DosGetProcAddr	DosQueryProcAddr
DosInsMessage	DosInsertMessage
DosMkDir/DosMkDir2	DosCreateDir
DosNewSize	DosSetFileSize
DosPTrace	DosDebug
DosQAppType	DosQueryAppType
DosQCurDir	DosQueryCurrentDir
DosQCurDisk	DosQueryCurrentDisk
DosQFHState	DosQueryFHState
DosQFileInfo	DosQueryFileInfo
DosQFileMode	DosQueryFileMode
DosQFSAttach	DosQueryFSAttach
DosQFSInfo	DosQueryFSInfo
DosQHandType	DosQueryHType
DosQPathInfo	DosQueryPathInfo
DosQSysInfo	DosQuerySysInfo
DosQVerify	DosQueryVerify
DosRmDir	DosDeleteDir
DosSelectDisk	DosSetDefaultDisk
DosSetProcCp	DosSetProcessCp
DosSetPrty	DosSetPriority
DosTimerAsync	DosAsyncTimer
DosTimerStart	DosStartTimer
DosTimerStop	DosStopTimer

Figure 4: These 32-bit OS/2-kernel API functions are essentially unchanged from their differently named 16-bit counterparts. Note that named pipe functions, many of which also have minor name changes, are omitted from this table.

FUNCTIONS ELIMINATED IN OS/2 2.0

DosCallBack
DosCLIAccess
DosFlagProcess
DosGetEnv
DosGetHugeShift
DosGetInfoSeg
DosGetMachineMode
DosGetPID
DosGetPPID
DosGetPrty
DosGetVersion
DosHoldSignal
DosLockSeg
DosMemAvail
DosPortAccess
DosR2StackRealloc
DosReadAsync
DosReallocHuge
DosReallocSeg
DosSendSignal
DosSetCp
DosSetSigHandler
DosSetVec
DosSizeSeg
DosWriteAsync

Figure 5: These 16-bit kernel API functions have no direct equivalent in the 32-bit API. Some have disappeared because they are CPU-architecture dependent; others have been supplanted by new functions. 16-bit VIO*xxx*, MOU*xxx*, KBD*xxx*, DosMon*xxx*, and semaphore functions have all been replaced.

THE IN-BOX

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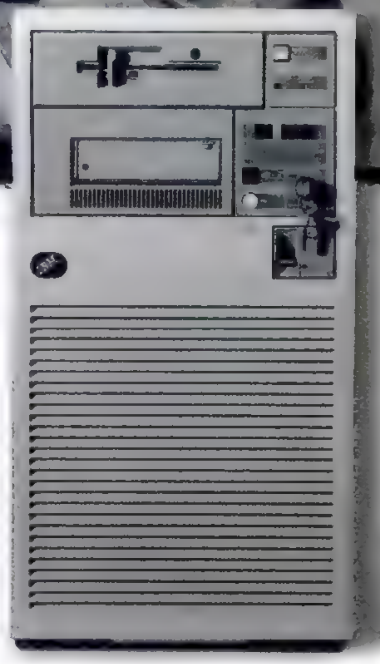

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by
William S. Hall

Windows

TSR PROGRAMS AND WINDOWS

Terminate-and-stay-resident programs (TSRs), such as *SideKick*, have become important adjuncts for many DOS users. Yet, in order to function simultaneously with other programs, a TSR must install *hooks* into the operating system. Typically these include keyboard, timer, and other hardware interrupts. And, when a TSR is used, its output usually includes part or all of the screen being used by another program; in the process, the current mode of the display may be changed. The situation can become frenetic when several TSRs are installed; more often than not, they don't play together very well.

Microsoft Windows adds yet another layer of complexity to the situation, because it wants to own all the resources of the machine and shares them only grudgingly. Joan Vu of Fullerton, California, expresses a typical situation when she writes

I want to be able to use various TSR programs when running under *Windows/386*. I can load a TSR and then run *Windows/386* with no problem. But for some reason I can't call up a TSR by using its hotkey. What can I do to get my TSRs working?

Ms. Vu's experience is not far from my own and that of many many others. Whenever I use the enhanced keyboard on a PC, my first step is to install a TSR called CAPCON, written by Patrick Swayne of the Heath Users' Group, to interchange the misplaced Ctrl and CapsLock keys from their current unusable positions. (I have never been able to fathom why IBM could design such a great keyboard for its Selectric typewriters and such bad ones for PCs. Worst of all, all other manufacturers follow the leader.) Yet when I run *Windows*, I find that I once again need a deformed hand in order to use the left Ctrl key. It is as if CAPCON did not exist.

Another problem occurs when a TSR does not correctly restore the state of the system after its use. From time to time, I need a screen-capture TSR program to save *Windows* displays. It works fine in *Window's/286*. But when I try to save a screen in *Windows/386*, the colors become substantially altered, and mouse movements begin to show up as screen writes along the bottom edge. It does not matter whether I run WIN86 or WIN386.

- TSR PROGRAMS AND WINDOWS: If you're having trouble using your favorite TSRs under *Windows*, you're not alone.
- THE MULTIPLE-DOCUMENT INTERFACE: New libraries and tools will help developers perfect the implementation of MDI in future *Windows* programs.

So, it is difficult to predict your success with TSRs. However, I can pass on some of the thoughts I've accumulated to give you a basis for experimentation. The rules are a bit different for *Windows/286* and *Windows/386*.

The basic principle applicable to all versions of *Windows* is simple: do not use TSRs if you don't really need them. Many of the features found in popular pop-up programs are provided in *Windows* desktop applications, and you should consider using these instead of pop-ups. TSRs, some of which are quite large, also take up memory that cannot be managed by Windows. Windows programs, on the other hand, use memory in a way that helps optimize the space available.

Of course, if you're like many of us, you don't use *Windows* all the time, and you still need your favorite TSR when in DOS. Hence, the second rule: load the TSR before running *Windows* but do not use it while *Windows* is on the screen.

Still, you may need the TSR while actually in *Windows*. The situation is somewhat analogous to what I was told in flying school about spinning an airplane certified for a one-turn spin. Once you pass one rotation, you become a test pilot. With possibly less disastrous consequences, try the TSR. If it works, fine; if not, you can take up the matter with the TSR's author or try to find a suitable alternative. As *Windows* becomes more and more respectable, software publishers are finding it increasingly necessary to ensure a degree of *Windows* compatibility.

If you use *Windows/386* not only to run other *Windows* programs but as a control program too, you have other possibilities. After running WIN386.EXE, execute a full-screen command shell by double-clicking on the COMMANDF.PIF file, and *then* run your TSR. If you have enough memory, you can run each of your TSRs in different shells. Each TSR will then be available in its respective shell. For the most part, TSRs loaded in this fashion should run without any trouble. Because each is running under its own DOS shell, none of these TSRs will be usable under *Windows* itself. However, TSRs that don't work properly when installed *before Windows* is run will probably work in the shell. Note that TSRs loaded in this manner will go away when you close your *Windows/386* session.

Finally, you may want to experiment with some of the features found in the *Windows/386* WIN.INI file if a TSR requires the use of a keystroke reserved by *Windows* or if your TSR allows you to select the keystroke sequence needed to invoke it. Use Notepad (the desktop text editor provided with *Windows*) to open the WIN.INI file—or simply double click on WIN.INI and find the following lines:

```
altescape=on
altenter=on
altspace=on
alttab=on
altprintscn=on
```

The AltEscape, AltEnter, and similar entries allow you to disable *Windows/386*'s use of these special Alt-key sequences. Normally they should all be enabled (set to on), in which case these sequences are used by *Windows/386* and are not seen by other applications. If you need to run an application that relies on one of these sequences, you may set that entry to off so that *Windows/386* will ignore that key sequence and pass it on to applications. For example,

```
altspace=off
```

frees up the Alt-Spacebar combination for your use with a TSR. If your TSR allows you to select your keystrokes, use one of the Alt options listed.

If you have some additional suggestions about TSRs, either of a general nature or relating to specific products, let me know so that I can share them with our readers.

THE MULTIPLE-DOCUMENT INTERFACE

I have discovered a bug in *Microsoft Excel* (or perhaps *Windows* itself). I once found myself without a mouse and had to use *Windows*' keyboard accelerators to get around. I discovered that when I use the keyboard, I can sometimes create floating menus (though perhaps *disembodied* menus is the better term). That is, I can make a menu that floats free of any window appear on the desktop. Nothing happens to the application—it still functions properly—but it is rather disconcerting. Perhaps you can shed some light on the mystery or report the bug to Microsoft.

William Dunlap
Newport Beach, California

You haven't discovered a bug by any means. What you've uncovered is one of the quirks of the Multiple Document Interface, a user interface style that will become more and more important to *Windows* applications.

Consider the screen shown in Figure 1. Note the location of the CHART window. CHART is a child window of the *Excel* main window and cannot be moved outside of *Excel*'s window. However, although you can't see most of the CHART window, it is still on the screen, only the part that falls outside the *Excel* window is invisible.

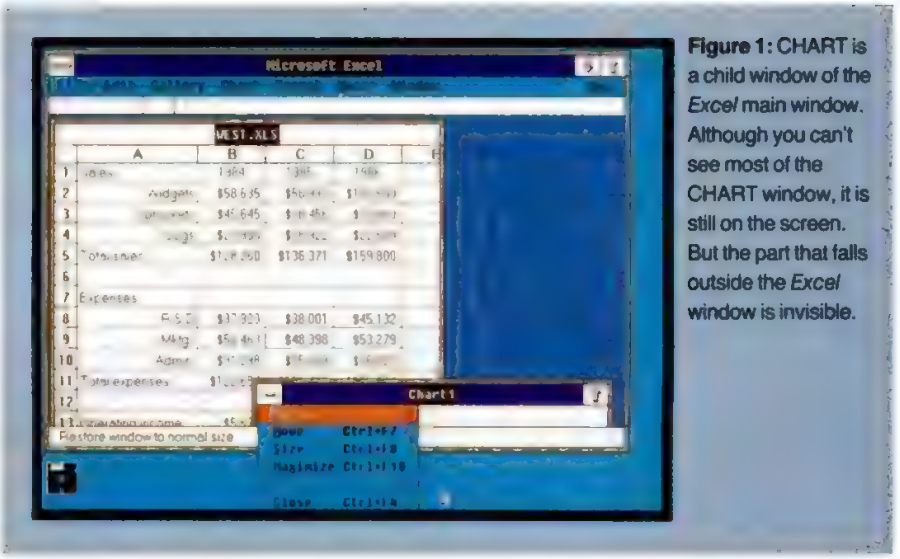

Figure 1: CHART is a child window of the *Excel* main window. Although you can't see most of the CHART window, it is still on the screen. But the part that falls outside the *Excel* window is invisible.

If the CHART window were to remain in place and the *Excel* main window were to be reduced in size, the location of the CHART window would remain unchanged. Though you cannot access it with the mouse, MDI lets you send keystrokes to the CHART window even when it is invisible. In Figure 2 I've done just that. Note that the menu appears in exactly the same location it did in Figure 1. Disconcerting perhaps, but definitely not a bug in the software.

If you have ever seen *Excel*, you will have noticed that each spreadsheet, macro, or chart on the screen is actually a window that, except for the lack of a menu, has many of the characteristics of the main window itself. Each has a title bar, system button, size button, scroll bars, and thick borders. In fact, the whole picture is one of a desktop within a desktop, and *Excel* was the first major *Windows* application to use this motif, now called the Multiple Document Interface, or MDI. Other applications, such as Future Soft's *DynaComm* are also using MDI. Destined to play an expanded roll in *Windows*, it is worthwhile to look at MDI from a user's perspective.

MDI is described in the Application Style Guide, Chapter 13, which is a part of the Windows Software Development Kit. A very nice article by Kevin Welch (which, although directed primarily at developers, is also a must-read for technical program managers and PC support specialists) can be found beginning on page 45 of the March 1989 issue of *Microsoft Systems Journal*. Welch has also provided an MDI library, now in the public domain and complete with source, that can serve as a basis for an MDI application. His company, Eikon, uses an enhanced version, and you may be able to negotiate its purchase for your own company's program development.

Let's begin by imagining a *Windows* screen containing a number of applications. Think of the screen as a desktop. Using a standard set of key commands (Alt-Tab, Alt-Esc, and so on) or the pointing device, you can move to any program and use, minimize, maximize, restore, resize, or close it. In a certain sense, you can regard each application's main window as a child of the desktop (although, technically speaking, the main window has no parent).

In an MDI application, its top-level window acts as a desktop to a collection of document windows contained within the main window. Each such window is a child window, and consequently, no part extends outside the application itself. More precisely, we say each document (or MDI) window is clipped to its parent. Each MDI window may contain different data or a different view of the same data. Using *Excel* as an example, one document might be a spreadsheet, and another could be a chart of the same information. In a word processor, each window may display the contents of different files. In a communications program, each window might be connected to a different COM port.

MDI MAIN WINDOW

Even experienced *Windows* users can be a bit baffled when confronted with an MDI application. However, the desktop window itself provides no real surprises. The

title bar usually contains the name of the application, and the system menu (the button to the left of the title bar) is equipped with the standard commands and Alt–function-key (Alt-F*x*) accelerators to restore, move, size, minimize, maximize, and close the window.

In addition, the desktop contains a menu, and if several different kinds of document windows are visible, you will notice that as you focus on each one, the contents of the menu bar may change. For example, some of the operations that are of interest to a spreadsheet may not be entirely relevant to its accompanying chart. In a multilingual editing program, if you move from editing a file in English to one in French, it may be appropriate to alter the menu's language as well.

Helping the user manage each of the documents is the Window pull-down menu item, which is the last one on the menu bar except for possibly the Help command. Typically, the commands on the menu include function groups to arrange the windows, hide and unhide them, and list them.

Because screen space is limited, some provision is really necessary to help you optimize the arrangement of the child windows. The usual choices are to cascade (as is done by Cardfile) or tile them. When they're tiled, each of the windows may be quite small, but this makes it easy to find the one you want.

The currently active window (the one with the active title bar), can be hidden by the Hide command. To get it back, choose Unhide. A list of hidden windows is presented, from which you can select the one to make visible.

Finally, each MDI window is either listed in the menu itself or a list box is activated to help you find the rest of them. At the very least, each is identified by a sequence number that acts as a mnemonic. In this way, you can bring any window to the top, even if you cannot find it in a cluttered desktop. The Window menu also provides a complete keyboard interface to managing the windows. Hence a mouse (although convenient) is not necessary.

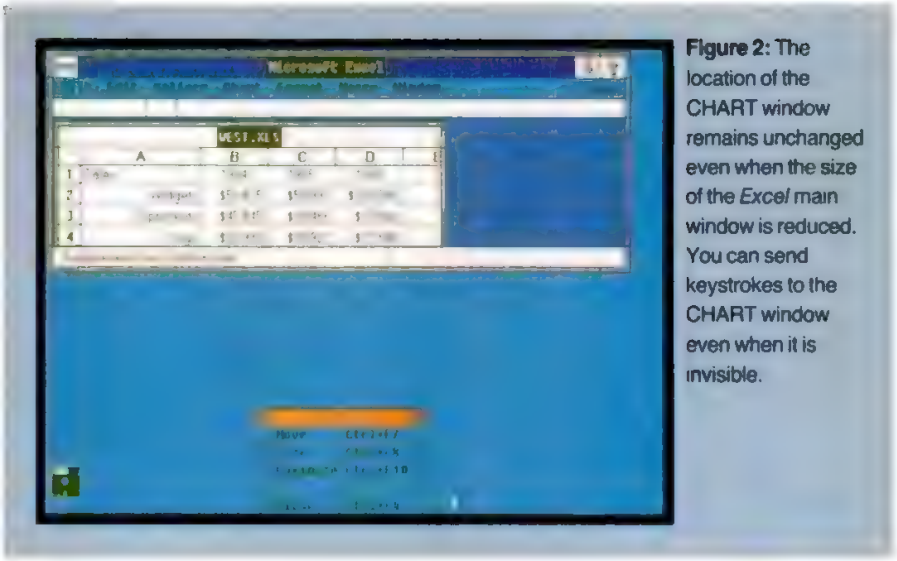

Figure 2: The location of the CHART window remains unchanged even when the size of the *Excel* main window is reduced. You can send keystrokes to the CHART window even when it is invisible.

THE MDI CHILD WINDOW

At first glance, a document window appears to be the same as the desktop. The title bar contains the name of the document being viewed, and if active, the title bar is the same color as the main window. In particular, if the application gains or loses the input focus, the active child's title bar follows that of the parent's.

However, whereas the main window will have both a main and a control menu, you will notice that an MDI window has only the latter. This menu can be activated with the mouse or with the Alt-Minus keyboard command. When it pops down, you will see the next big difference: although the menu selections are the same, the Alt-F*x* accelerator keys have been replaced by Ctrl-F*x* keys. And usually the Minimize command is grayed. It is also not inconceivable that an application may have an icon for a class of document windows and allow the window to be minimized. In such a case, the icon would appear in the lower part of the application's main window, and additional commands may be necessary in the Window menu to manage the icons.

When an MDI window is maximized, another interesting event occurs. As would be expected, the window expands to fill the main's client area. The title bar is stripped from the window and the title is added to the the main title bar. The main menu is redrawn to add the child's control menu as the leftmost item. In this way, an MDI window can occupy the same area as the desktop. In fact, if the desktop itself is then maximized, the MDI window follows, and if another document is selected from the list, it is also shown maximized. In this way, a document window can utilize the maximum available screen space. In some early realizations of MDI, the title bar was not removed. I recall that some program managers had objected to MDI on the basis of this "limitation." However, in a proper MDI implementation such is not the case.

MOVING THROUGH DOCUMENT WINDOWS

Every well-written *Windows* program provides two ways of accomplishing a task—with a pointing device or by means of the keyboard. MDI is no different. To select the next document window use Ctrl-F6, and to shift backward use Shift-Ctrl-F6. Similarly, to move among objects within a given document window the commands are F6 and Shift-F6. Given the right window coordinates for the main and a child window, you can arrive at a situation where a keyboard accelerator will bring up a floating window.

The Multiple Document Interface is today an accepted program interface standard for *Windows* that is just now being realized by some applications. Until recently, however, it has been somewhat difficult to implement fully in the current version of *Windows*. However, libraries and tools have been developed and made available to developers, and it is expected that MDI will be a principal feature of many new *Windows* programs.

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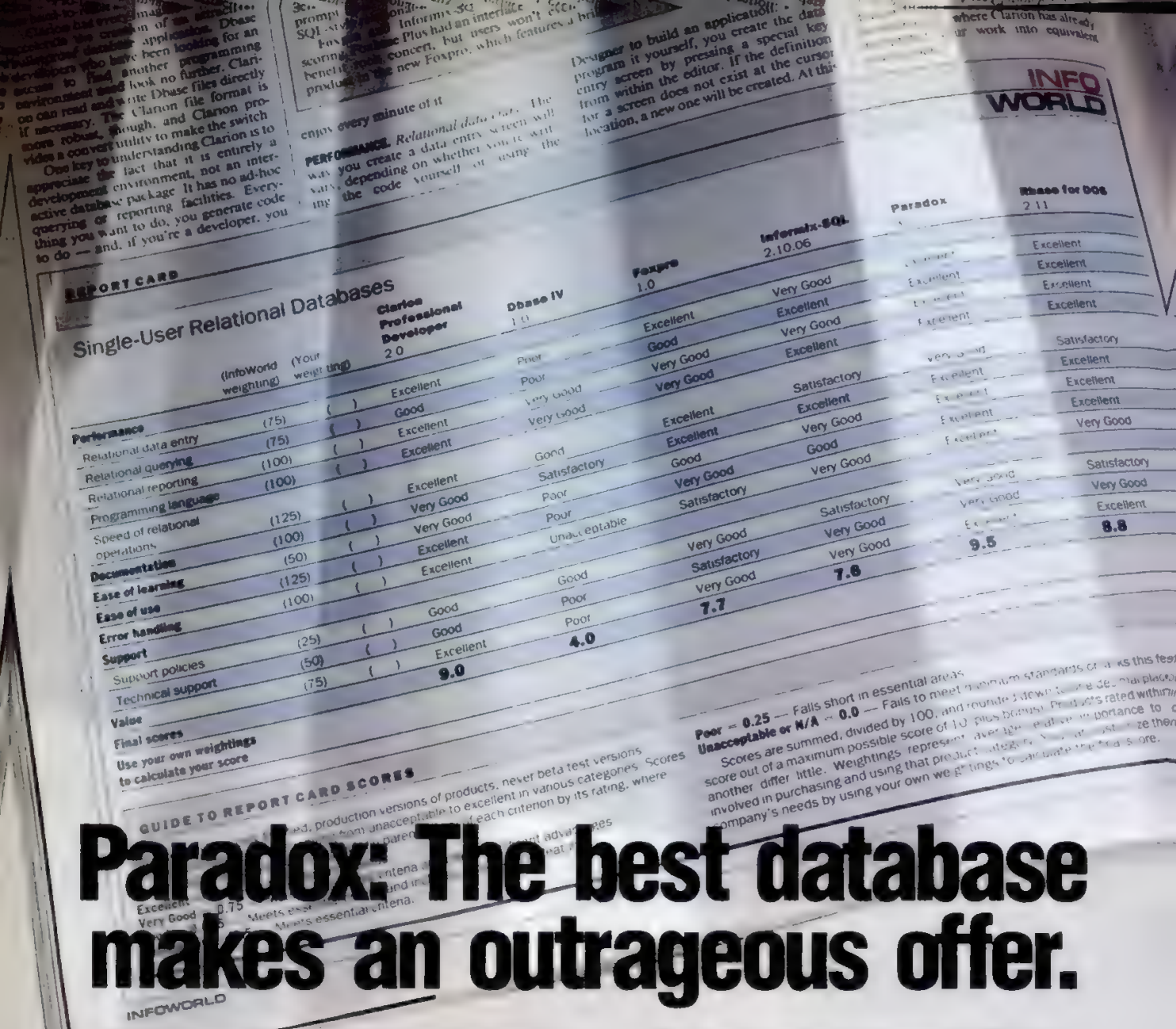

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edited by
Trudy Neuhaus

Databases

This time and next, we'll take a look at a few of the tips and questions some of you have sent in.

Sorting through your letters, I wasn't surprised that the biggest stack belonged to *dBASE*, nor that the second largest was for *Clipper*. What did surprise me, though, was that I only had *three* piles (every so often, a *FoxBASE* user would surface). No letters on *R:BASE*, *Paradox*, *DataEase*? Well, maybe next time. Right now, hot tips and slick workarounds for *dBASE*, *Clipper*, and *FoxBASE* will be the topics for discussion.

SELF-NAMING PROCEDURE FILES

Once a finished *FoxBASE* application has been merged with foxbind into one long procedure file and compiled with foxpcomp, it can't be renamed without reediting and recompiling.

This is because, according to the manual, the combined procedure file starts by naming itself. For example, say the program is called PAYROLL.PRG. The foxbound procedure file would begin with

```
SET PROCEDURE TO payroll
DO main
PROCEDURE main
.
.
PROCEDURE sub1
.
.
```

Now if you subsequently rename PAYROLL.PRG to something else, it will crash on the SET PROCEDURE command.

Here's a little trick that adds the needed flexibility:

```
prgname = SYS(16)
SET PROCEDURE TO &prgname
```

This allows the filename to be changed without recompiling the program. I put it at the top of all my complete applications.

Steve Freides
New York, New York

- SELF-NAMING PROCEDURE FILES: Rename a FoxBASE program without recompiling it.
- UNIQUE VARIABLE NAMES: Create a unique variable name to use as a temporary filename with this simple routine.
- SPEED UP BROWSE: Quickly BROWSE a few records in a large database.
- CLIPPER'S UDFs: Clipper's UDFs can extend the power of Label or Report Forms.
- SORTING THROUGH AN INDEX: Skirt SORT's limitations and space requirements by indexing.
- QUERIES SET EXACT ON: dBASE IV safeguards JOINing two databases by setting EXACT when a query is issued.

Speedier execution is probably the best reason for *FoxBASE* programmers to combine their finished applications into one long procedure file. DOS is rather inefficient in searching directories to find the various program files, and this delay is avoided if the whole application is included in a single DOS file.

Using SYS(16), which returns the name of the program currently being executed, lets the file be renamed. An even easier approach is to omit the SET PROCEDURE command. Provided all the application's procedures are incorporated at the end of the main program, *FoxBASE* will process them correctly without invoking SET PROCEDURE.

UNIQUE VARIABLE NAMES

dBASE III and *IV* have no built-in function to create a unique or random variable name that can be used as a temporary filename or memory variable name. This would come in handy when, for example, you're copying, renaming, or sorting to a temporary database.

The program below creates a unique three-character numeric string ranging from "000" to "999". Use this as your filename, or combine it with another string, as we have done with:

```
u1="ATEMP"
u2="000"
DO WHILE FILE(u1+u2+".DBF")
  u2=SUBS(STR(&u2+1001,4),2,3)
ENDDO
uniqname=u1+u2
```

The procedure works for creating unique memory variable names if you substitute

```
TYPE(u1+u2)#"U"
```

for

```
FILE(u1+u2+".DBF")
```

Delete any temporary files created.

John Erdovegi, Jr.
Lakewood, Ohio

Because complications are sure to arise if an identical filename (or memory variable) is used in a program, we've all resorted to outrageous filenames in our attempts to create a temporary filename that "couldn't possibly" exist. This is especially dangerous in *Clipper*, where, for example, the RENAME command will fail if an identical filename already exists and no error is registered.

Of course, you could assume that if an

identical filename already exists, it should be erased. But that's dangerous, too.

This simple routine avoids the problem entirely by searching—up to 1,000 times—for a currently unused monicker. To shorten or lengthen the number of searches, simply adjust the lengths of u1 and u2.

FoxBASE users have it easy when this need arises: they can simply call SYS(3) for a unique, legal filename.

SPEED UP BROWSE

If you've ever tried BROWSEing a few records in a very large database, using *dBASE*'s SET FILTER TO command, you know it takes *forever* to get control of the screen. Then if you hit PgUp or PgDn, there's another seemingly endless delay.

I created a program (Figure 1) that has a smaller built-in delay at the start and a very quick BROWSE. By way of explanation, suppose you're working with a large file, INVOICE.DBF. It's indexed on the invoice number and also has a customer number field that relates each transaction to CUSTOMER.DBF. You want to BROWSE all the transactions for a given customer (or a given month, or another criterion).

Start by making a temporary database of just those records you want to examine and only one field: the key invoice number field. Next, USE the temporary file and relate the main database to it. Then BROWSE the temporary file, but—and here's the twist—specify the fields from the main database with the BROWSE FIELD command and the ALIAS-> descriptor.

Wayne Thomas
Hanson, Massachusetts

If you need to BROWSE a small percentage of records in a large file, the results of this tiny program are spectacular—especially when compared with using *dBASE*'s SET FILTER TO command. In addition, all the keypad keys work correctly and immediately. If you do other work with the same subgroup of records, such as COUNT, SUM, and REPLACE, you'll save even more time.

There is an important limitation, however. The indexed field(s) that are copied out to the temporary file must be UNIQUE in the main database. So, for example, to copy out the invoice number field, there must be only one unique record for each invoice number. If there are multiple records with the same invoice number, only the first record will be accessed. Sometimes you can get around this limitation by copying out (and indexing on) more than one field, such as the invoice number *and* item number.

This technique applies to all *dBASE* languages starting with *dBASE III Plus*.

CLIPPER'S UDFs

I find *Clipper* UDFs (user-defined functions) extremely handy inside Label Forms. For example, if my labels need to reflect multiple fields of IIF() conditionals, the built-in limit of 60-bytes per line is often too short to hold the entire expression. However, sometimes UDFs seem too good to be true. Do they have any limitations?

Mark Albrecht
Union City, Pennsylvania

Like all *Clipper* UDFs, those in form and label runs can perform almost any programming task you wish, such as averaging, doing lookups into another file, or branching to different outputs depending on the data in each record. There are only two limitations: the UDF must return a value of the same type (character, numeric, or logical); and, if the UDF is combined with other expressions, the entire line must constitute a valid expression.

Because the Form Generator supplied with *Clipper* (RL.EXE) is crude and buggy, most *Clipper* programmers rely on interactive programs like *FoxBASE* or *dBASE* to create their .FRM and .LBL files.

Unfortunately, these programs will reject your UDFs as invalid expressions and will not allow you to enter it. The workaround is to enter a valid *dBASE* function, save the file, and then use the Norton Utilities (or any similar program) to modify the finished .FRM or .LBL file. The number of bytes used to express the dummy *dBASE* function must be the same as your UDF. In other words, you could use the Norton Utilities to change the 13-byte expression, STR(field,7), into any 13-byte UDF expression, such as UDF(field,7) or UDFX1(a*0.01).

Given the repetitive nature of forms and labels, it's generally best to avoid anything in the UDF that requires user input. Even this may have a place, however, if a lookup fails or a number must be entered manually, depending on the context.

SORTING THROUGH AN INDEX

In *dBASE* programs, you can INDEX a file using functions like SUBSTR() or SOUNDEX(), but you can't SORT using functions. If you need to sort by functions, you can get around SORT's limitations by indexing the file and then issuing the command

```
COPY TO <newfile>.
```

The resulting *newfile* will be sorted in exactly the order it was indexed.

Paul Hazard
Dover, New Hampshire

While experienced programmers know to do this, many new or intermediate users may not.

This technique has additional advantages as well. For example, if the index already exists, it's much faster than sorting. Moreover, with very large files, you may not have enough disk space to SORT. A typical SORT requires three times as much space as the original file: you need enough disk space to hold the original file, an intermediate scratch file, and the finished file. With extremely large files, more than one scratch file is required. Indexing very large files may also entail intermediate scratch files, but unless the index key is long and the file structure small, index files generally consume less space.

QUERIES SET EXACT ON

When issuing a query in *dBASE IV*, I've noticed that the SET EXACT command changes to ON. This is inconvenient when

SET FILTER TO ALTERNATIVE

```
SELECT A
USE invoice
COPY FIELD inv_no TO temp FOR cust_no="1234"
SET INDEX TO inv_no

SELECT B
USE temp
SET RELATION TO inv_no INTO A

BROWSE FIELD A->date,A->qty,A->desc   && etc.
```

Figure 1: A timesaving method for BROWSEing only a few records in a large *dBASE* file.

I'm doing an indexed search, because I must enter the entire key value, not just the first two or three characters.

A solution is to exit the browse or edit screen, set EXACT OFF, and return to the browse or edit screen. But, this is awkward, so I found a way to patch *dBASE IV* so queries don't change the EXACT setting.

Examining a .QBE file, I found that it begins with several *dBASE* commands, one of which is always SET EXACT ON. Unfortunately, .QBE files can't be edited as ordinary text. So I decided to change *dBASE IV* so that it writes this line as a comment, not as a command. The short BASIC program

```
10 OPEN "DBASE1.OVL" AS #1 LEN = 1
20 FIELD 1, 1 AS C$
30 S$ = "* SET EXACT "
40 FOR X = 1 TO 12
50 LSET C$ = MID$(S$, X, 1)
60 PUT 1, 157078 + X
70 NEXT X
80 CLOSE
90 END
```

patches the DBASE1.OVL file so that it replaces SET EXACT ON with the comment

```
"* SET EXACT "
```

The current EXACT setting will now remain unchanged when a query is opened.

Before running this program, make sure you have a backup copy of the original DBASE1.OVL file. This patch works with *dBASE IV*, Version 1.0, and may not work with later updates.

Kelly Shinmoto
Weston, Ontario, Canada

This BASIC patch will disable the SET EXACT ON command in .QBE files. However, if you then try to JOIN two large databases (with EXACT OFF), you may wish you hadn't tried this workaround. According to a technical representative at Ashton-Tate, SET EXACT ON is issued because when you JOIN files under relational theory, you must make sure the keys match exactly. Moreover, changing DBASE1.OVL violates the license agreement.

There's a far better (nonsurgical) solution built right into *dBASE IV*, which uses the new wildcard capability of the LIKE operator. For example, if you want to find all last names beginning with ABC, go to the name field (while in the QBE server) and enter LIKE "ABC*". As in DOS, both the * and ? wildcard characters are supported. In effect, this will override SET EXACT ON for this field.

Ashton-Tate forgot the little housekeeping chore of restoring the setting of EXACT to its prequery state. So if you have SET EXACT OFF before the query, you must change it back afterward. Supposedly, this will be fixed in Version 1.1.

LET US HEAR FROM YOU

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Research for this article was provided by Brad Stark, a frequent contributor to PC Magazine.

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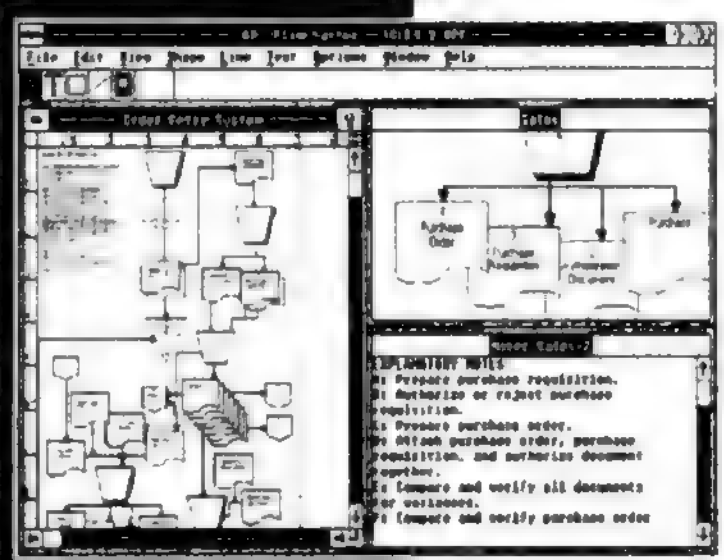

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by
Craig Stinson

Spreadsheets

- **TIMELY FOOTERS:** Identify spreadsheet printouts not just by date but by time as well.
- **DETERMINING THE RELEASE:** Run this macro to find out which version of Lotus 1-2-3 you're using.
- **SELECTING RANGES IN EXCEL:** Three ways to activate ranges that leave scroll bars in the dust.

TIMELY FOOTERS

When printing a series of revisions to a *Lotus 1-2-3* spreadsheet, you can distinguish the most recent version by including the date in a header or footer. But I have often been frustrated that the program does not provide a way to include the time as well. The macro shown in Figure 1 creates a footer with both the date and time.

Three range names are required. The cell named TIMEFORMULA stores the @NOW function. The cell named TIMESTRING is a string format of TIMEFORMULA. The cell named \T holds the start of the macro; to invoke the macro, press Alt-T.

The macro ends with the worksheet in READY mode, but you could make it end in the main Print menu by removing one Q from line 7. You could also personalize this macro by adding your company name between the two vertical bars in line 5. If you want your time stamp to appear in a header rather than in a footer, substitute an H for the F in line 5.

John C. Peace
Vernon, Connecticut

PC MAGAZINE *Lotus 1-2-3* replaces an at sign (@) in a header or footer with the current date when you print your worksheet. But the program doesn't provide a corresponding code to add a time stamp. If you want the time of a printout recorded in a header or footer, you need to type it in manually or use a macro such as the one provided by Mr. Peace.

The {CONTENTS} statement in the first line of the macro assigns the value in the cell named TIMEFORMULA to the cell named TIMESTRING. In the process the statement converts the time from a formula to a label. This step is necessary because the contents of a header or footer must be text.

The third and fourth arguments of the {CONTENTS} statement determine, respectively, the width and format of the TIMESTRING. In Mr. Peace's macro, the value 120 specifies a label in Lotus's standard short time format—HH:MM AM/PM. And the value 10 results in a label that begins with one blank character. If you don't want that blank, replace the 10 with a 9.

Lines 5, 6, and 7 in Figure 1 jointly specify your footer string. Line 5 issues the /Print Printer Options Footer command and then types a Z. As we'll see in a moment, the Z is a dummy character; you can substitute a different letter if you want, but you need some letter between the F and the {esc} in line 5.

When you type /PPOF in *1-2-3*, the program prompts with "Enter footer:" followed by the last footer string you used. The {esc} in line 5 clears that last footer string, so the macro can enter your new one. The dummy character ensures that there will be something on the prompt line to clear; without it, the {esc} might take you back one level in the menu tree, which is definitely not what you want.

The footer string ends with whatever label has landed in the cell named TIMESTRING. The tilde and Qs in line 7 terminate the footer command and return you to the worksheet. If you want, you can make the macro start the printout instead of taking you back to the worksheet. Just replace the second Q in line 7 with the letters AG (for Align, Go).

The @NOW formula that supplies the current time for the footer does not have to be located in line 3. It can be anywhere on your worksheet, provided its cell is named TIMEFORMULA.

Mr. Peace's macro works in all versions of *Lotus 1-2-3* later than 1A.

DETERMINING THE RELEASE

I've written a macro that determines which version of *Lotus 1-2-3* is in use—Release 3, Release 2.2, or Release 2.01. There are important feature differences among the three versions, and with the help of my macro, I can vary my applications to accommodate the version in use.

The routine is shown in Figure 2. If you run this macro in a Release 3 worksheet, it enters the value 3 in the cell named RELEASE (B6). If you run it in a Release 2.2

TIME INCLUDED IN HEADERS AND FOOTERS

```
        A          B          C          D          E

2
3    TIMEFORMULA @NOW
4    \T          {contents timestring,timeformula,10,120}
5                /ppofz{esc}@||
6    TIMESTRING   08:58 PM
7                ~qq
```

Figure 1: This simple macro puts the time into the headers or footers of spreadsheet printouts. The process converts @NOW to a label in one of the time formats. The value 120 in the contents statement specifies Lotus's standard short time format.

worksheet, it enters the value 2.2. If you run it in Release 2.0 or 2.01 (these two versions are functionally identical), the macro enters the value 2.

J. Parker
New York, New York

Mr. Parker's technique does the job. The {Let} instruction in B1 writes the result of @INFO("release") in B6. The @INFO function was introduced in Release 3, so if the macro is running in that version, the label '3.00.00 is deposited in B6. But if the macro is running in an earlier version, *1-2-3* doesn't recognize—and therefore can't evaluate—@INFO; the macro simply writes

```
'@INFO("release")
```

as a label in B6. No matter what result is placed in RELEASE, the macro then moves to execute the next statement.

The second statement, at B2, uses an {If} instruction to test the first character in B6. If the first character is anything other than an @ sign, the macro replaces the value of B6 with the value 3; then it quits. However, if the first character in B6 *is* an @ sign, the result of the {If} test is false, so execution continues with the third statement—at B3.

The third statement uses another {If} test to determine whether the result of @ISERR(@CELLPOINTER("filename")) is an error. The filename option for @CELLPOINTER was introduced with Release 2.2. So if the macro is running in Release 2.0 or 2.01, the function @CELLPOINTER("filename") produces an error. The {If} test in B3 is then true, so the macro replaces the contents of B6 with the value 2 and quits.

If @CELLPOINTER("filename") doesn't generate an error, then the {If} test in B3 proves false. Macro execution continues at B4. Since the only remaining possibility is that the version in use is Release 2.2, the macro replaces the contents of B6 with the value 2.2.

One point to note about all this: Lotus recently began shipping *Lotus 1-2-3/G*. If you want all the bases covered, you'll need to modify this macro when the G version appears. As it stands now, the macro would return the value 3 at B6 when running under Release 3 or *Lotus 1-2-3/G*.

RELEASE MACRO — **COMPLETE LISTING**

```
      A        B        C        D        E        F        G        H
1   \a       {Let RELEASE,@INFO("release")}
2            {If @LEFT(RELEASE,1)<>"@"}{Let RELEASE,3}~{Quit}
3            {If @ISERR(@CELLPOINTER("filename"))}{Let RELEASE,2}~{Quit}
4            {Let RELEASE,2.2}~
5
6   RELEASE
7
```

Figure 2: Use this macro to determine which release of *Lotus 1-2-3* (2.01, 2.2, or later) is being used. You might have to revise it to accommodate *Lotus 1-2-3/G*.

SELECTING RANGES IN EXCEL

In the course of my work with *Microsoft Excel*, I often need to select ranges that extend beyond the portion of the worksheet that is currently visible on the screen. To do this, most people drag the mouse pointer into the vertical or horizontal scroll bars, the column of row numbers, or the row of column letters. This causes *Excel* to scroll new rows or columns of the worksheet onto the screen at a moderate pace.

> When you drag the mouse to a point completely outside the active *Excel* window, new columns and rows scroll on-screen about twice as fast as when you drag the mouse into the scroll bars, columns, or rows.

There's a faster way to select large ranges: drag the pointer to a position completely outside the active window. When you do this, new columns and rows scroll onto the screen more quickly—about twice as fast as when you drag the mouse into the scroll bars, the columns, or the rows.

If you are working in a maximized window, you are somewhat limited. You can always scroll quickly in the upward direction, since the menu bar—an area outside the worksheet—is always visible on-screen. But the scroll bars and row numbers are at the right, bottom, and left edges of a maximized window, and you must restore the window—and thereby reveal an area beyond those edges—if you want to scroll quickly in those directions.

Charles Caruthers
Ann Arbor, Michigan

That's an interesting discovery. "Stretching the selection" into the *Windows* desktop speeds up scrolling indeed. And you can also use this technique for quick navigation when you just want to browse through the contents of a large worksheet.

But there are some even faster ways to select large ranges in *Microsoft Excel*. For example, you can begin by activating the cell at one corner of the range you want to select. Then use the scroll bars to bring the cell at the opposite corner of the range into view and hold down the Shift key as you click on that corner cell. *Excel* highlights the rectangular range that has those two cells in opposite corners.

If you know the address of the cell at the opposite corner of the range, there's an even faster way to make that selection. After activating the cell at one corner, press F5 (Goto), type the address of the opposite-corner cell, and then hold down the Shift key and press Enter or click OK.

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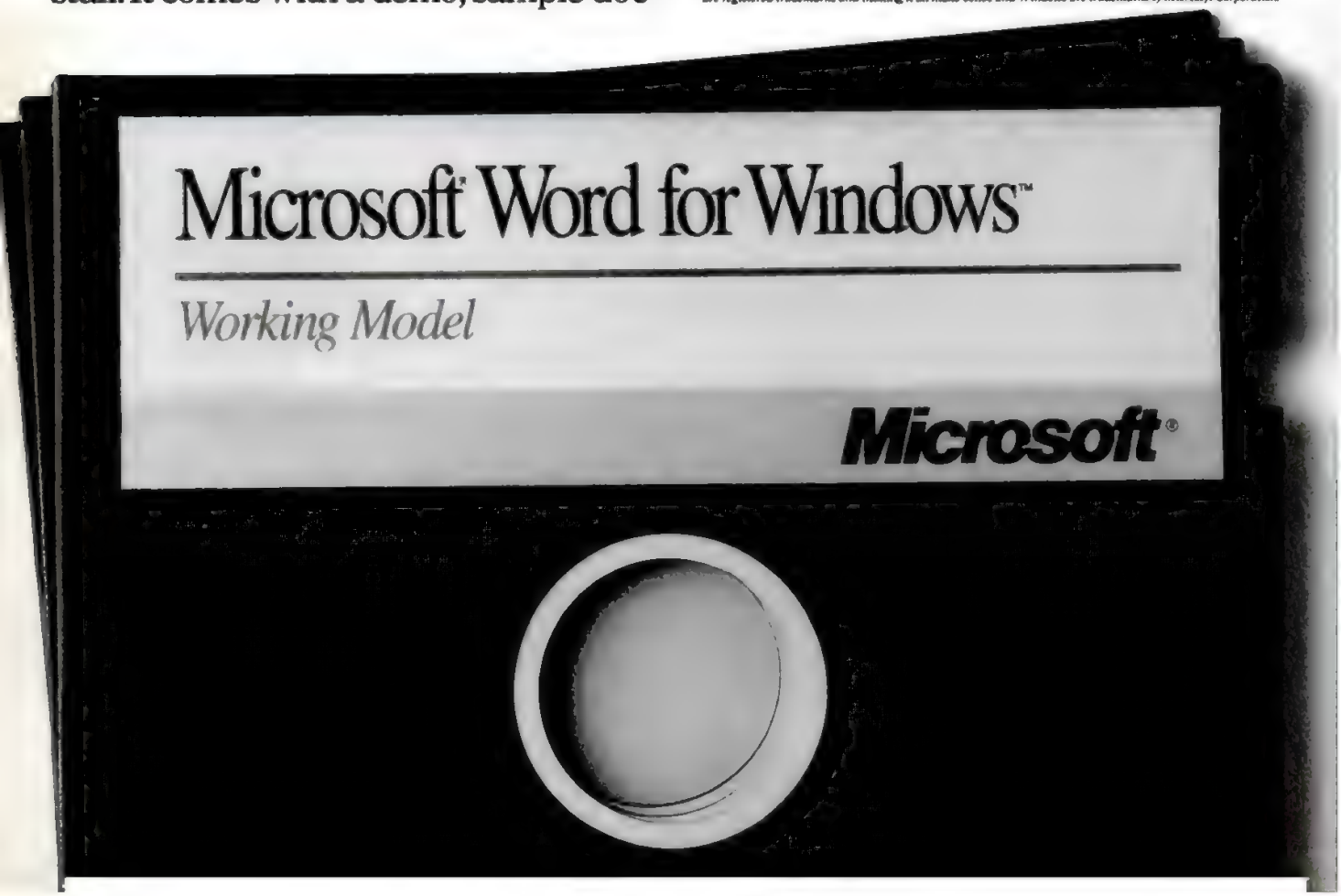

by
Craig L. Stark

The Working Word

SIMPLIFY MASTERING WORDPERFECT

One of the advantages of The Working Word's new format is that it provides a place to discuss some of the ancillary programs that might not otherwise be reviewed but that nonetheless can contribute significantly to readers' word processing productivity. *Companion*, designed to work with *WordPerfect* 5.0 and 5.1 (a separate version is available for Verision 4.2), is just such an add-in program. It is available from PsyBorne Inc. (714 Palmerston Ave., Toronto, Ontario, Canada M6G 2R1; (416) 536-6610), and it costs $89.95.

To describe its operation briefly, *Companion* substitutes a mnemonically based command-style interface for many of the *WordPerfect* editing procedures whose keystrokes and menu selections invariably get written up on the office "cheat sheet" for those who can't remember them. *Companion* also provides several "commands" that are not native to WP, though they could be programmed to be so using the Macro Editor. Indeed, *Companion* itself consists of a collection of approximately 250 very systematically designed macros that give *WordPerfect* the kind of operating style that appeals to users who prefer command-driven applications.

SEEING THE PROBLEM

Its popularity notwithstanding, *WordPerfect* is *not* an easy program for many of us to learn and use. Suppose you simply want to copy a line of text from one point to another in your document. Standard *WordPerfect* operations let you do this in one of several ways. First, you can Block (or select or define) the text to be copied by hitting Alt-F4 and moving the cursor to the end of the line. But you can't complete the blocking operation (thus turning off the blinking Block On prompt and letting you move the cursor), until you know which command to issue next. And since Copy isn't listed on the *WordPerfect* template, you must either look it up (page 487 of the Version 5.1 manual) or hit F3 and go to the help screens, where you'll find it three screens down in the *C* listings.

> ■ If you're a fan of command-driven interfaces, Companion may be the add-in you're looking for to simplify learning and using WordPerfect.

Either way, you're told to hit Ctrl-F4. This gives you the choice of moving a (1) Block, (2) Tab Col, or (3) Rectangle. Yet you don't want to *move* the selected text, only copy it, and since you're already in the middle of defining a block, I'm puzzled as to why you should have to tell *WordPerfect* that you want to move a block. Still, exercising an existential leap of faith, pick 1 for Block. This presents you with another menu: (1) Move, (2) Copy, (3) Delete, or (4) Append. After picking 2, you can finally move the cursor to the spot where you want the copy to land, and hit Enter. (If you have an enhanced BIOS, you'll find—from the manual—that there *is* a shortcut to the Ctrl-F4 menu stage: highlight the text, hit Ctrl-Ins, move the cursor to the landing point, and hit Enter.)

The alternative is to realize from the start that if you want to copy some text, you must defy the plain meaning of words and tell the program that you want to move the text, *before* you block it. You begin this, again, by hitting Ctrl-F4, but your menu choices are now (1) Sentence, (2) Paragraph, (3) Page, or (4) Retrieve—none of which may seem applicable. *WP* treats a line that ends in a hard return as a "sentence," so you can select 1, after which you get the Move-Copy-Delete-Append menu choices again. But if your line doesn't end with a hard return, you must start over again, using the Block procedure. The logic of the menus here and the difference in Ctrl-F4's operation simply baffles me, and that makes the program hard for me to learn and use.

In the fully command-driven program *XyWrite*, hitting F4 completely Blocks (defines) a line of text. (Alternatively, to start defining text you hit F1, move the cursor to the end of the desired area, and then close the defined area by hitting F1 again.) You then move the cursor to the landing spot, and hitting F7 copies the block there. All these commands are on the template. If you wanted to put another copy of the block elsewhere in the document, in *WordPerfect* you'd either have to repeat the whole multimenu procedure or, if you can remember it, you would hit Alt-F4 and then hit Ctrl-Home *twice* to redefine (but still not close) the block. In *XyWrite* you'd simply move the cursor and hit F7 again. You do have the additional cost in *XyWrite* of having to use a keystroke (F3) to unblock your highlighted text. (In *XyWrite*, only when you *move* something is the defined area automatically cleared, since you might want to do something else with it—copy it to a file, print it, append it to another file, change its text/font attributes, and so on.)

This is an unusually straightforward *XyWrite* procedure and an unusually obtuse *WordPerfect* procedure, but it should make you realize the productivity price you must often pay, not only in keystrokes but in lost concentration and frustration, for the "ease" of selecting from menus. As with most command-oriented applications, most *XyWrite* commands are executed by hitting a command key (F5), typing in a mnemonic (TY for type, SA for save, RM for right margin, and so on) and then hitting Enter.

COMPANION COMMANDS

Companion executes its commands in a way similar to ordinary *XyWrite* commands. (*Companion* also has a few single-key commands, which I'll discuss below.) Regular *Companion* commands all begin with a single command key: Alt-Z (comparable to F5 in *XyWrite*). So, to copy a

line of text using *Companion*, you hit Alt-Z, then type c (for copy). (You'd type d for delete, m for move, t for transpose, and so on). The next letter indicates what you wanted to copy: l for line, s for sentence, p for paragraph, w for word (which then asks for the number of words you want included), or t for text (where you define the amount by moving the cursor—as you do with the Alt-F4 Block On in *WP*.) Hit Enter and, as in *WP*, move the cursor where you want the copy. Hit Enter again, and it's there.

This kind of logic runs through *Companion*'s whole command structure. True, since p is used for paragraph, you have to learn to use g for page, but this is a familiar problem with single-letter choices. The command letters also include b for bold, u for underline (bu for bold underline), k for uppercase ("kapitals," since c has already been used), l for lowercase, and f for font selection. If you're deep in a document and want to go back and copy a paragraph to your present cursor location, you hit Alt-Z, followed by ccp (copy to cursor, paragraph). Similarly, mm (move to me) commands will move text to the current location. A series of w commands opens, closes, and lets you move or copy text to a window. A complete series of fc (copy to a file) and fcc (copy to cursor from a file) commands let you select not only lines, paragraphs, pages, and the like, but a whole document (fcd), as well.

If *Companion* did no more than this it might still be worth it, but the *WordPerfect* user would be stuck with the "old-style" commands for all but some basic editing functions. Fortunately, *Companion* provides advanced commands that follow the same logic for printing, replacing codes, column definitions, headers, footers, and base fonts; for creating indexes, lists, tables of contents and of "authorities;" for inserts and multiple inserts; for creating graphic lines and boxes; for sub- and superscripting; for paragraph outlining; for keyboard redesign; and a good deal more.

One rather unique *Companion* addition to the standard *WordPerfect* repertoire are the tt (transpose text) commands, which will even (in Version 5.1) allow swapping *nonadjacent* pages, lines, paragraphs, and so on. For *WordPerfect* 5.0 users the *Companion* mr (merge) commands facilitate creation of the necessary secondary files, and the *WordPerfect* View options are vastly expanded so that you can preview a document not simply in terms of different sizes and page layouts, but on the basis of selected fonts, page breaks, redlined areas, and more. In short, then, *Companion* provides much more than aid and comfort to the rank beginner or office temporary.

Figure 1: This is the first of a series of *Companion* help screens that will take you through every facet of the program.

SINGLE-KEY COMMANDS

Companion also has some 20 Alt-key macros for cursor and screen movements, deletions and transpositions, single-word bolding and underlining, single-letter upper- or lowercasing, and the like. Alt-F and Alt-P provide menus of file and print functions, Alt-R repeats a command, and—predictably—Alt-H shows *Companion* help screens, one of which is shown in Figure 1, above.

WordPerfect's ALTERNAT keyboard has its own set of single-key macros, and since many users have their own Alt-key macros, conflict is inevitable. What to do?

If you keep your own or *WordPerfect*'s Alt-letter macros stored in the main \WP directory rather than in a keyboard/macro subdirectory, *Companion* will rename them during its installation procedure. (Installation takes less than 5 minutes.) Your Alt-T will become @-T, for example. But if your (or *WP*'s) single-letter macros are stored—as they should be—in a keyboard/macro subdirectory, they will remain untouched, and they will take precedence over the single-letter macros *Companion* provides. This does not mean, however, that you lose the benefit of the macros that *Companion* supplies in Alt-key form. Logically, all of them can be accessed from the *Companion* subdirectory by prefixing them with the Alt-Z command key.

CONTRAINDICATIONS

You may have noticed that, being a command-oriented application user, I'm tremendously impressed with *Companion*. Personally, I think WordPerfect is silly to stand by its "not invented here" policy; it should distribute the program itself.

Nevertheless, as with any program that radically changes the behavior of an established program, there are certain contraindications for use of *Companion*. If you really need to learn *WordPerfect* itself—to program macros, for example, or to know the program so that you can sit down at any machine that has *WordPerfect* on it and proceed straightaway, *Companion* obviously won't help. Indeed, it's so easy to use as a crutch that it *could* actually slow down your learning the "real thing."

Different people will react differently to this possible slowdown, however, and certainly if you have to use *WordPerfect* either infrequently or temporarily, or if you don't have to be a *WordPerfect* power user and guru, *Companion* is a godsend. Its documentation is clear, and its three tutorial lessons are more than adequate. Above all, it makes a program that many of us love to hate into one we grudgingly hate to love.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing tips, and we'll pay you $50 for any tips we print. Please send your letter on a disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). ■

by
Neil J. Rubenking

User-to-User

WHAT DAY IS IT?

DDATE.BAT (Figure 1) allows you to find out which day of the week corresponds to the date you enter, without affecting the system date. The command

```
DDATE 12-31-2099
```

quickly tells you that the 31st of December 2099 is a Thursday. DDATE.BAT requires DDATESET.BAT, as follows:

```
SET weekday=%1
IF '%day%'==='' SET day=%2
```

The REM command in line 2 of DDATE creates an empty batch file that is used as a carrier of the redefined prompt (line 3). This prompt is echoed into EMPTY.BAT (line 4) by means of COMMAND /C.

The prompt string includes the name of the batch file DDATESET followed by $d, which means EMPTY.BAT contains something like DDATESET Thu 12-31-2099. DDATESET will be activated when EMPTY.BAT is called in line 5. DDATESET sets environment variables to the two needed parameters.

As you can see, DDATE performs almost the same steps twice, once to save the real date and once to display the desired day. The second line in DDATESET .BAT is relevant only during the first round, as it preserves the actual date for restoration in the DATE command (line 13 of DDATE). And the first line is relevant in the second round, where it returns the desired day of week.

Dick J. Pluyter
Leiderdorp, Netherlands

DDATE.BAT — COMPLETE LISTING

```
@ECHO OFF
REM > EMPTY.BAT
PROMPT DDATESET $d
COMMAND /C EMPTY.BAT > EMPTY.BAT
CALL EMPTY.BAT
DATE %1
REM > EMPTY.BAT
PROMPT DDATESET $d
COMMAND /C EMPTY.BAT > EMPTY.BAT
CALL EMPTY.BAT
PROMPT $p$g
ECHO %weekday%
DATE %day%
DEL EMPTY.BAT
FOR %%f IN (weekday day) DO SET %%f=
```

Figure 1: Use your PC's internal day-of-the-week calculator to tell you what day of the week a given date will fall on.

- **WHAT DAY IS IT?** Let DOS tell you the day of the week for any date from 1980 to 2099.
- **AN EASIER WAY TO USE ANSI COMMANDS:** Store ANSI commands in mnemonic environment variables and use them to beautify your batch files.

PC MAGAZINE DDATE will work *only* under DOS 3.3 or later. It needs the CALL command, which was introduced in DOS 3.3. Don't try to replace CALL with COMMAND /C. DDATESET sets some important environment variables, and when you change the environment from a batch file under COMMAND /C, you're not changing the master environment. Your changes disappear as soon as the batch file ends. Note that DDATE does affect the system date, in a sense. It changes it momentarily, then resets it to the current date. If the batch file gets interrupted before it finishes, double-check to make sure the correct system date was restored.

DDATE can work only for dates between 1980 and 2099, since these years represent the limits of the PC's internal calendar.

It does seem a shame to spend a whole disk cluster on the two-line batch file DDATESET—and it's not necessary. Figure 2 is a batch file that incorporates the function of DDATESET into itself. Instead of calling another file, it calls *itself* with the command-line parameter SET.

XDATE.BAT — COMPLETE LISTING

```
@ECHO OFF
IF '%1'=='SET' GOTO set
REM > EMPTY.BAT
PROMPT XDATE SET $d
COMMAND /C EMPTY.BAT > EMPTY.BAT
CALL EMPTY.BAT
DATE %1
REM > EMPTY.BAT
PROMPT XDATE SET $d
COMMAND /C EMPTY.BAT > EMPTY.BAT
CALL EMPTY.BAT
PROMPT $p$g
ECHO %weekday%
DATE %day%
DEL EMPTY.BAT
FOR %%f IN (weekday day) DO SET %%f=
GOTO end
:SET
SET weekday=%2
IF '%day%'==='' SET day=%3
:END
```

Figure 2: Save disk space by combining the functions of DDATE and DDATESET.

AN EASIER WAY TO USE ANSI COMMANDS

I use ANSI.SYS to give color to my batch files. To simplify operation, I put commonly used ANSI commands into the environment with the SET command. All batch files

SED.BAT — COMPLETE LISTING

```
ECHO OFF
set DIR=D:\BAT
set RAM=C:
set el=←[K
set top=←[H
set up8=←[8A
set up4=←[4A
set up2=←[2A
set up1=←[1A
set hide=←[8m
set chelp=←[0m
set cprom=←[0m
set cline=←[0m
set reset=←[0m
%1
```

Figure 3: This batch file sets up mnemonic environment variables as synonyms for useful ANSI commands.

SE.BAT — **COMPLETE LISTING**

```
ECHO off
SET file=%0d.bat
SET return=%file% %0
IF NOT EXIST %dir%\%file% GOTO reset
:next
SET return=GOTO old
IF %1==! GOTO help
IF %1==r GOTO reset
IF %1==R GOTO reset
IF %1==s GOTO show
IF %1==S GOTO show
IF %2:==! GOTO help
IF %3:==! GOTO help
IF %1==/h SET color=chelp
IF %1==/H SET color=chelp
IF %1==/p SET color=cprom
IF %1==/P SET color=cprom
IF %1==/l SET color=cline
IF %1==/L SET color=cline
IF %1==/s SET color=reset
IF %1==/S SET color=reset
REM ---- Change one color choice. ----
REM Make a copy of SED.BAT, omitting the OLD choice for that color.
TYPE %dir%\%file%|FIND/V "%color%"|FIND/V "%%1">%ram%\%file%
REM Create a file with a line that sets the NEW choice.
ECHO SET %color%=[%2;%3m>%ram%\temp
ECHO %%1>>%ram%\temp
REM Copy the changed file back to SED.BAT
COPY %ram%\%file%+%ram%\temp %dir%>NUL
del %ram%\%file%
SET end=%file%
:old
REM Grab another three parameters from the command line
SHIFT
SHIFT
SHIFT
IF %3:==! GOTO end
GOTO next

:reset
REM Re-create the original version of SED.BAT by...
REM ECHOing each of its lines to a file.
ECHO ECHO OFF>%dir%\%file%

rem Change the next line to match your hard drive
ECHO SET DIR=D:\bat>>%dir%\%file%

rem Change the next line to match your ram disk or hard drive
ECHO SET RAM=C:>>%dir%\%file%

ECHO SET el=[K>>%dir%\%file%
ECHO SET top=[H>>%dir%\%file%
ECHO SET up8=[8A>>%dir%\%file%
ECHO SET up4=[4A>>%dir%\%file%
ECHO SET up2=[2A>>%dir%\%file%
ECHO SET up1=[1A>>%dir%\%file%
ECHO SET hide=[0m>>%dir%\%file%
ECHO SET chelp=[0m>>%dir%\%file%
ECHO SET cprom=[0m>>%dir%\%file%
ECHO SET cline=[0m>>%dir%\%file%
ECHO SET reset=[0m>>%dir%\%file%
ECHO %%1>>%dir%\%file%
SET end=sed
%return%

:show
REM Show the environment, but omit the ANSI variables.
CLS
ECHO %chelp%%top%
ECHO The Current Environment is:
SET |find/v "["
ECHO %reset%
SET end=
GOTO end
:help
SET fix=[A=[24C
ECHO %chelp%%up8%%up8%%up8%%up1%
ECHO %up1%┌──────────────────────────────────────────────────────┐
ECHO │        Color SET Routine for Batch Files                  │%cline%
ECHO │──────────────────────────────────────────────────────────│%chelp%
ECHO │ SED will setup last SET of color values                   │
ECHO │ SE R will ReSET the colors to the default                 │
ECHO │ SE S will Show current Environment                        │
ECHO │ SE /H %% %% sets the help menu color                      │
ECHO │ SE /P %% %% sets the prompt colors                        │
ECHO │ SE /L %% %% sets the single line colors                   │
ECHO │ SE /S %% %% sets the screen colors                        │
ECHO │──────────────────────────────────────────────────────────│
ECHO │=[30;40m30 40=[31;40m|31 40=[32;40m|32 40=[33;40m|33 40
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ECHO %fix%=[34;47m|34 47=[35;47m|35 47=[36;47m|36 47=[37;47m|37 47%chelp%│
ECHO └──────────────────────────────────────────────────────────┘
SET fix=
ECHO %reset%%up1%
SET end=
:end
SET return=
SET color=
%end%
```

Figure 4: This batch file maintains the SED.BAT file and sets the colors you choose.

then use the environment variables for controlling color and moving the cursor. SED.BAT (Figure 3) sets the colors I want to use. My batch files are much easier to write now—it's simpler to remember that %up1% moves the cursor up one line than to remember the corresponding ANSI code.

SE.BAT (Figure 4) helps you set up SED.BAT. Edit it to reflect your drives and have your AUTOEXEC.BAT call SED. SWAP.BAT (Figure 5) exchanges two filenames. Running SWAP without parameters brings up a help menu that uses the mnemonic ANSI commands. *[Note that the ← in these batch files represents the escape character.*—Ed.*]*

Edward H. Kidera IV
Columbia, Maryland

Most text editors let you insert an escape character into a batch file, but it's rarely easy. And, when you use TYPE or MORE to display a batch file that contains ANSI commands, those commands actually take effect, making it hard to read the file. By isolating the escape sequences in your own SED.BAT, you can avoid such problems.

SE.BAT is a complex batch program. Its techniques are worth studying, but you can get ANSI mnemonics without typing all those lines. Just build SED.BAT, with your own color choices. The colors are 0—black, 1—red, 2—green, 3—yellow/brown, 4—blue, 5—magenta, 6—cyan, 7—white. For a background color, put a 4 in front of the number; for foreground, a 3.

By writing your own SED.BAT, you gain the opportunity to use high-intensity colors, which SE.BAT ignores. The general form for an ANSI color command is `<esc>[##;##m`, where the `##;##` symbols represent the numbers for foreground and background colors. To make a high-intensity color, add `;1` just before the `m`. For a low-intensity color, insert `0;` right after the `[`. For example, bright yellow on blue would be `<esc>[33;44;1m`, and dark red on white would be `<esc>[0;31;47m`. Experiment until you have your own preferred set of colors.

SWAP.BAT — **COMPLETE LISTING**

```
ECHO OFF
:P %1:==! goto help
:P %2:==! goto help
REM %1 temp1
REM %2 %1
REM temp1 %2
GOTO end
:help
ECHO %up8%%chelp%
ECHO
ECHO │          Swap file names                    │%cline%
ECHO │─────────────────────────────────────────────│%chelp%
ECHO │ Specify two files names to be swapped       │
ECHO │ such as:                                    │
ECHO │ SWAP FILE1.TXT FILE1.BAK                    │
ECHO └─────────────────────────────────────────────┘
ECHO %reset%%up1%
:end
```

Figure 5: SWAP.BAT uses the mnemonic ANSI environment variables to display an attractive help screen.

SHARE YOUR SECRETS

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by
Jeff Prosise

Tutor

IMPORTING AN AUTOCAD DRAWING

Can you please tell me, step by step, how to import an *AutoCAD*, Release 10, drawing into *WordPerfect* 5.0?

Rob Kennedy
New York, New York

Sure. In order to import *AutoCAD* files into *WordPerfect*, you need to convert the *AutoCAD* output file into a format that *WordPerfect* 5.0 can understand. The file conversion is a two-step process. First, save the *AutoCAD* drawing file either as an HPGL (Hewlett-Packard Graphics Language) plot file or as a .DXF file. Then convert the resulting file to .WPG (*WordPerfect* Graphics) format with *WordPerfect*'s GRAPHCNV.EXE utility. You can put this .WPG file into any *WordPerfect* document.

Here's the procedure in detail. I'll use .PLT files for this example. To start, go into *AutoCAD* and change your plotter selection. Tell *AutoCAD* you have an HP 7475 plotter and that you want to output plots to a file rather than to a device. Save the configuration changes and return to the main *AutoCAD* menu.

From the menu, launch a drawing session to edit the drawing you want to export to *WordPerfect* and plot the drawing. After asking you for a filename, *AutoCAD* will write an HPGL plot file to disk with the name you give it and the three-letter extension .PLT. That's the first step.

WordPerfect 5.0 won't accept an *AutoCAD* drawing file, nor will it deal directly with an HPGL plot file. However, its GRAPHCNV.EXE utility will translate an HPGL plot file, as well as files in a number of other popular graphics formats, to the .WPG format.

To start the second step, exit *AutoCAD* and copy the newly created plot file to whatever directory you store *WordPerfect* 5.0 document files in. Then change to that directory and type

```
GRAPHCNV filename.PLT filename.WPG
```

- **IMPORTING AN AUTOCAD DRAWING:** Follow this simple procedure to import AutoCAD graphics into WordPerfect.
- **EXTENDED KEYBOARD SERVICES:** How to determine whether a BIOS supports extended keyboard functions.
- **TEACHING A TSR NEW TRICKS:** Learn to write intelligent TSRs that know how to stay out of the way when necessary.

where *filename* is the name you assigned to the *AutoCAD* plot file. If you prefer, you can simply type GRAPHCNV and you'll be prompted for the names of the input and output files.

Now, start *WordPerfect* and move the cursor to the point in the document where you want to insert the drawing. Press Alt-F9 to invoke *WordPerfect* 5.0's Graphics menu followed by 1 to select the Figure option and 1 again to select Create. Type 1 a final time to select the Filename option in *WordPerfect*'s Figure Definition menu and enter the name of the .WPG file you created. Be sure to include the .WPG extension when you enter the filename.

Finally, exit the Graphics menus by pressing F7 and press Shift-F7 followed by 6 to preview the document. At this point you should see the *AutoCAD* drawing displayed in a box alongside any text that was already there when the figure was created. If the size, position, or orientation of the drawing is not to your liking, all is not lost—you can make changes as needed by pressing Alt-F9, 1, 2, to edit the envelope of the drawing or Alt-F9, 1, 2, 8 to edit the drawing itself.

Easy? Yes—once you know how. The mistake many *WordPerfect* 5.0 users make is attempting to read .DXF or .PLT files straight into *WordPerfect* without first running GRAPHCNV.EXE to convert them or attempting to convert .DWG files directly. Follow this simple procedure and the process of importing *AutoCAD* graphics into *WordPerfect* should be a snap.

EXTENDED KEYBOARD SERVICES

Hawkeye—you remember, my pet parrot, the FORTH programming expert—chided me when he spotted an error in my November 14, 1989, Tutor column. One of the discussions featured a code listing to illustrate how a program can determine whether the BIOS supports extended keyboard functions. Unfortunately, a flaw in the logic prevented it from properly identifying a BIOS that doesn't support them.

Figure 1 shows a corrected version of the code. The original discussion focused on using interrupt 16h, function 10h to trap presses of function keys F11 and F12. Recall that these keys don't register if the keyboard BIOS's conventional keyboard read service, function 00h, is used to solicit keyboard input.

The new version of the code clears the keyboard buffer by setting its head pointer equal to its tail pointer (the offset addresses where the next buffered keycode will be read from and written to, respectively), then uses functions 05h and 10h to write a keycode to the keyboard buffer and read it back. If either call fails, execution is routed to the portion of the code that takes action once it is determined that extended keyboard services are not supported.

The first test involves function 05h, which writes the 2-byte keycode passed to it in CX to the keyboard buffer. If the call succeeds, AL will return 0. The only other valid return code is 1, which indicates the keyboard buffer is full. Clearing the buffer beforehand ensures that a buffer-full condition won't occur. On most any BIOS, AL will also return 0 if it was set to 0 on entry and function 05h isn't supported. To

make sure this doesn't fool the program into thinking the function call was processed when it really wasn't, the routine in Figure 1 presets AL to FFh and checks it on return. If function 05h isn't implemented, AL will return still holding the value FFh; otherwise it should return 0.

The call to function 10h reads the buffer entry back so that the program won't get a false keycode the first time it pauses for a keystroke. The very act of reading the buffer verifies that the BIOS supports extended keyboard reads. Function 10h is not supported if AX returns a value other than that which was written to the keyboard buffer earlier with function 05h.

TEACHING A TSR NEW TRICKS

Is it possible to write a TSR that can tell what program is running at any point in time? Better yet, is it possible to write one that knows when the user is on the DOS command line so that it can act only then and stay out of the way when an application program is running?

Anthony Hamilton
Overland Park, Kansas

It is—to a degree. A TSR can get the address of the active PSP (program segment prefix) from DOS using function 62h and use that address as an indicator of what's running. By tracing through the chain of memory control blocks, a TSR can find out what program owns the PSP by backtracking until it finds an environment block with the same owner. DOS 3.*x* copies the name of the program into the environment block. Although function 62h didn't appear until DOS 3.0, a program running under DOS 2.*x* can get the address of the active PSP using the undocumented function 51h. But it can't do much with it: versions of DOS prior to 3.0 don't copy the program name into the environment block.

The address of the active PSP is the closest thing DOS has to a process ID. When a program is loaded, DOS records its PSP address. While the program runs, calls to functions 51h and 62h return this address. When the program terminates, DOS switches the active PSP address to that of the command processor.

In theory, at least, the active PSP belongs to the program currently executing, since DOS is a single-tasking operating system. But theory doesn't always hold to reality. When a TSR grabs control asynchronously from a running application program (or from DOS itself), it may or may not activate its own PSP with a call to undocumented DOS function 50h. If it doesn't, and if your program requests the address of the active PSP while the other TSR is running, it will receive the PSP address of the program that was interrupted—even though that program is temporarily suspended.

Another potential problem is the practice some TSRs employ of deallocating their environment blocks prior to becoming memory-resident, in order to conserve memory. Even if one of these TSRs activates its own PSP when it takes control, your TSR can't backtrack to determine who owns it, because the environment block where the program's name was stored is gone.

Another approach—one that is valid with DOS 2.*x* as well—is to hook into interrupt 21h with your TSR and monitor calls to the DOS EXEC function, keeping a record of what programs are loaded and when they terminate. Properly implemented, this gives you a hard-and-fast means of correlating program names to PSPs. But even this isn't without flaws: there's still the problem with TSRs. RAM-resident programs are EXECed only once (when they're installed), and take control thereafter by keying on asynchronous events such as keyboard and timer interrupts. Even with this higher-level approach, you still can't ensure at a random moment in time that the current thread of execution doesn't belong to a TSR.

So what's the solution? There's not one that will work in every situation, but specific problems sometimes yield specific solutions. One example is TSRs that replace DOS's buffered input function (function 0Ah) with their own function to enhance the command-line interface.

The approach Douglas Boling and I took with ALIAS (a command-line utility that appeared in the December 26, 1989, Utilities column) was to record the PSP address of COMMAND.COM when our program was installed and compare that address with the address of the active PSP every time function 0Ah was called. While there were no assurances that the call came from COMMAND.COM and not a TSR running on top of COMMAND.COM when the addresses matched, we reasoned that no TSR in its right mind would risk crashing the system by invoking function 0Ah (for reentrancy reasons that we won't go into here). While the method isn't 100 percent foolproof, it works the vast majority of the time.

TESTING FOR BIOS SUPPORT OF EXTENDED KEYBOARD SERVICES

```
mov  ax,40h              ;Clear the keyboard
mov  ds,ax               ;  buffer of entries
mov  ax,ds:[001Ah]
mov  ds:[001Ch],ax

mov  cx,0FFFFh           ;Call function 05h
mov  ax,05FFh            ;  to insert a keycode
int  16h                 ;  into the buffer
or   al,al               ;Not supported if AL
jnz  not_supported       ;  returns nonzero

mov  ah,10h              ;Now read the keycode
int  16h                 ;  back and see if it
cmp  ax,0FFFFh           ;  matches
jne  not_supported       ;Not supported if AX
                         ;  is not 0FFFFh
          .
          .
```

Figure 1: The process involves running a pair of tests: one to write a keycode to the keyboard buffer using function 05h, and one to read it back using function 10h. If either test fails, then extended keyboard services are not supported.

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively. Questions about DOS and systems in general are also answered. Send your questions to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

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The keyboard isn't squeezed either. The distance between the "Q" key and the "[" (left bracket) key measures 7.5 inches, just as PC Magazine suggests. All the keys are of standard size. We have also provided a separate jack which allows you to plug in a standard 101-key keyboard if you wish.

CHECK IT OUT!

The Perfect Portable has many features of obvious importance. Also, there are a number of features that are subtle yet critical to your ultimate satisfaction. We'll go over them here one by one. We're confident you'll agree, the ZEOS 386SX Portable is in fact, the Perfect Portable.

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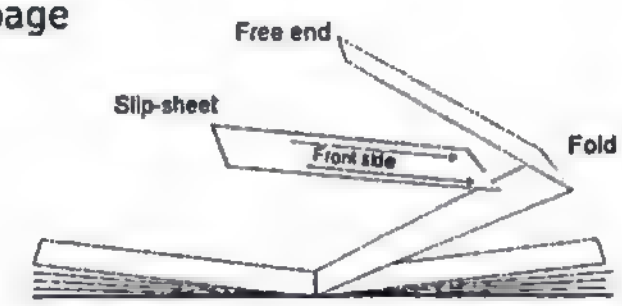

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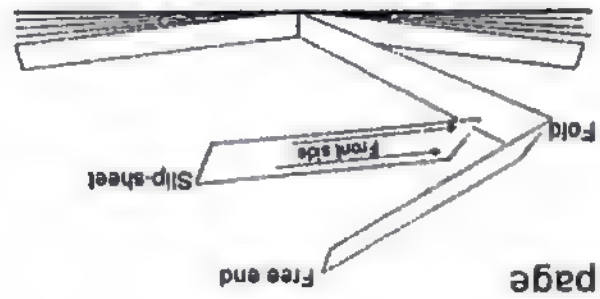

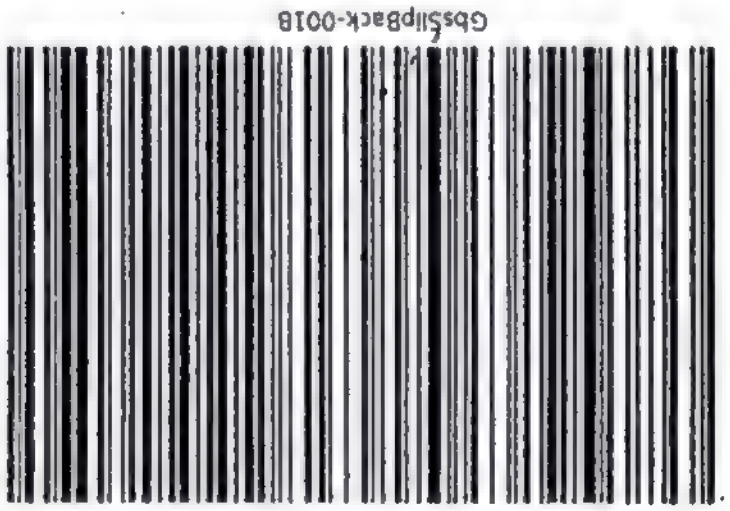

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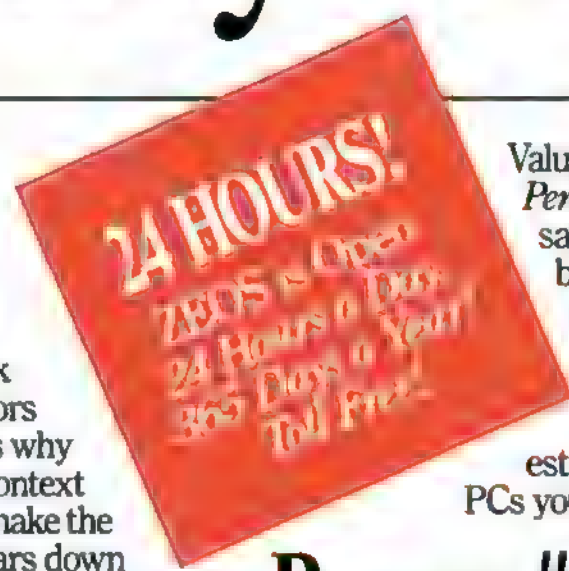

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Requested Line of Credit $ _____

Your Name _____ First Initial Last **Date of Birth** _____ Mo. Day Yr.

Present Address _____ Street Apt. # City State Zip

Social Security Number _____ ( ) Home Phone

Date of Residence _____ Month Year **Monthly Payment** $ _____ ☐ Buy ☐ Rent ☐ Other

Previous Address _____

_____ **Dates of Residence** _____ From To

Your Employer _____
(If self-employed, see rear panel.)

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

Previous Employer _____ **Address** _____

_____ **Dates of Employment** _____ From To

Other Income _____ I have received since (Date) _____
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____ Gross $ Net $

Name and Address of Nearest Relative Not Living With You _____

_____ Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Loan Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Bank Card Reference _____ Bank Name Address

_____ ☐ VISA ☐ Mastercard Payment _____ Balance _____

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.
☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information
☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history.* This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____ First Initial Last

Date of Birth _____ Mo. Day Yr. **Social Security Number** _____

Address _____ Street Apt. #

_____ City State Zip

Date of Residence _____ Mo. Yr. **Home Phone** ( )

Employer _____

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

☐ Proprietorship ☐ Corporation ☐ Partnership **Business Phone** ( )

Description of Business _____

Your Position _____ **In Business Since** _____

Your annual income from business _____ **Business' annual income** _____ (gross) (net)

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( ) Telephone _____ Personal Banker's Name

2. Accountant's Name _____

( ) Telephone

3. Financial statement on business attached.

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Connectivity

AN INVESTMENT IN PERFORMANCE

In *PC Magazine*'s LAN Blockbuster (May 29, 1990) we reviewed many high-powered servers, and the tests revealed the importance of fast hard disk response times. The speed of the hard disk subsystem is the number-one factor—much more important than processor type or speed—in server performance, and the disk controller is a critical part of the hard disk subsystem.

Most controllers simply move data between the drive and the computer's bus. They translate signals and arrange data in appropriate formats for each side. But a caching controller card has abilities beyond this; it can also use its intimate connection to the drive to grab and hold large chunks of data in on-board RAM.

This sort of caching technique is even faster than moving the data through the system bus to a cache maintained by the operating system in the computer's RAM. Of course, the first query into the data comes back only as fast as the mechanical access of the drive will allow. But subsequent queries for related data can make the drive appear to have an amazing .3 ms access time.

If you have a DOS-based LAN operating system, particularly one without its own cache in RAM, then adding a caching disk controller can make an enormous difference in performance for many types of applications. The difference won't be as remarkable under *NetWare* or *LAN Manager* because they have efficient RAM-caching schemes, but you will see an improvement in how fast database, accounting, and similar applications get their data from the server.

Recently, some folks from CompuAdd visited the *PC Magazine* LAN Labs to demonstrate the company's HardCache/ESDI Controller. Incidentally, CompuAdd is a mail-order company that's in the LAN market in a big way.

Our tests in the LAN Labs show that the CompuAdd HardCache/ESDI Controller is one of the best investments in performance a LAN administrator can make. The $495 starting price includes 256K of on-board memory for caching. If your network client stations access a lot of different database segments at the same time, you should consider the $925 board with 4MB of RAM. The caching controller mimics the drive partitions dynamically. Just as applications use different portions of the drive table, the controller uses different portions of the on-board cache memory. So if you have a lot of applications using a lot of different files, you need more on-board memory.

- **AN INVESTMENT IN PERFORMANCE:** A caching disk controller can make an enormous difference in performance.
- **PORTABLES PUZZLE:** Some Compaq portables can't seem to communicate with a VAX.
- **AUDIT AND CONTROL ON A LAN:** Shells and menus provide monitoring functions for networks.

Note however, that you must use this controller with an ESDI drive, so it might not be an exact replacement in your existing hard disk drive subsystem. But it's a breeze to install under *NetWare*.

CompuAdd is a source for other LAN products as well. We frequently get calls and letters from people looking for sources of reasonably priced LAN products. It seems that many system integrators (the common outlet for LAN products) sell network interface cards and other goods at high prices—even when they aren't adding any value to the unopened box. CompuAdd is an excellent alternative to consider for many LAN products, including Western Digital Ethernet and Token-Ring adapters, and Thomas-Conrad Token-Ring cards. An important consideration in buying products from CompuAdd is its technical support staff—including over 70 people with LAN training. These technical support people can answer questions about how their products fit into networks and help you through any installation problems. Call CompuAdd at (800) 288-6574 for more information on the HardCache/ESDI Controller and the company's other LAN products .

PORTABLES PUZZLE

We have what seems to be a unique PC-VAX communications problem.

Our company has a VAX cluster with DEC VAXes ranging from 11/750s to an 8350. Several MicroVax IIs communicate with the cluster over Ethernet. PCs and terminals interact with the VAXes through direct connections, modems, and Ethernet terminal servers. In general, everything runs smoothly.

We use a wide variety of PCs, and for the most part they all interact well with the VAX cluster. However, there is one notable exception. Some Compaq portables will not communicate with the VAX through an Ethernet DECserver.

Some of our Compaqs, including a Compaq Deskpro 286, a Compaq Deskpro 386S, and an original Compaq Portable with AST's *SixPak Plus*, work just fine. However, our Compaq Portable 286 and Compaq Portable III display only garbage on the screen. Commands typed on the keyboards of these machines execute normally on the VAX, but the results come back as garbage on the screens. Neither DEC nor Compaq has been able to give us any help. Any ideas?

John J. Vasconcelos
Pasadena, California

I have three suggestions, but no guarantees. First, load the ANSI.SYS screen driver in your CONFIG.SYS file. Many programs use this driver to handle keyboard input and

screen output—it knows how to respond to screen-cursor-positioning commands. The ANSI.SYS driver is an option in IBM's versions of DOS, but some companies, like NEC and Texas Instruments, make it integral to their versions of MS-DOS. My Compaq MS-DOS manual lists ANSI.SYS as a separately loaded driver. Whenever you see garbage on the screen, your first reaction should be to check for ANSI.SYS.

Second, call Compaq and ask if updated versions of the ROM BIOS for the computers that don't work correctly are available. Every LAN manager should know what version of ROM BIOS is in every network machine (often a sign-on message or the CTRL-ALT-ESC CMOS setup menu will tell you). When you run into a pattern of problems, you need some easy way to check for ROM BIOS incompatibilities.

Finally, make sure your network interface cards are using an appropriate memory location. Depending on the type of video adapter you have installed, you could have video RAM and ROM sitting between A0000h and C7FFFh. Some popular adapters, such as the Western Digital EtherCard PLUS, use a default buffer memory address of C4000, which falls in that same range. It isn't likely that the network cards will communicate if their buffer memory is at a conflicting memory address, but since you're investigating every possible source for the problem, you should go ahead and examine this one too. It never hurts to be thorough.

This is a difficult problem to pin down, but your letter shows that you've followed a logical process in trying to identify the common elements. Have any other readers experienced this Compaq-to-VAX incompatibility?

AUDIT AND CONTROL ON A LAN

I'm an average PC user, dreaming of one day becoming a full-fledged power user. But it's certainly true that "in the land of the blind the one-eyed man is king." In my case, because no one else in the office knew anything about PCs, I suddenly found myself in charge of a network with 36 users running under Novell's *NetWare 286*.

I'm puzzled, however, by the lack of what I'd consider basic administrative utilities in Novell's software. Utilities, for instance, that would let me know how well we are using the system or how close we are to the limits of the hardware.

Is there a utility buried somewhere that will allow me to print out all station IDs, user names, files they use, file statistics (date and size), last access, and so on? The *NetWare* accounting system appears to be aimed at people who charge users for network services—not at those managing the system.

Randy E. Glasnapp
Georgetown, Maine

First of all, are you aware of the Monitor program on the file server? Monitor shows CPU utilization and pending I/O requests. These are very general indicators of activity, but if CPU activity rises to over 40 to 60 percent on your 386 server and you get more than a few pending I/O requests, you need to further investigate what has been happening on the server.

> Several companies are on the verge of shipping *NetWare* Loadable Modules—programs running on the *NetWare 386* Server that will monitor and report on every possible parameter of system operation.

A better answer to your question is that the management services you request are getting closer all the time. There's an architectural problem you need to understand. The kind of monitoring and reporting you ask for is done best at the file server. However, until recently, file server hardware had its electronic hands full simply handling file activity requests, without the added duty of running monitoring programs. Consequently, the best available network management programs were designed as shells or menus to run on each workstation. The workstation CPUs divided the monitoring, authorization, tracking, and management loads.

The problem with this architecture is that you must customize each workstation shell or menu program for its user and then tell it how to make reports back to a file in some shared subdirectory for compilation. The whole process is often a heavy workload for the administrator and intrusive to the workstation user.

The best menu programs we have seen are *Saber Menu* ($395 per server) and *Saber Meter* ($195 per server) from Saber Software ((800) 338-8754). You'll need both programs to come close to getting the features you want. If you want a program with more emphasis on virus protection and security but one that still provides some of the management, monitoring, and reporting features, check out *Certus LAN* from Foundationware. This package costs $795 per file server. Contact Foundationware at (800) 722-8737.

It's not exactly good news for you, but the fact is that since economical 386-based computers arrived, CPUs in file servers have been loafing. Machines based on the 386 have the processing capacity to handle file requests and still have time to do lots of other things as well. So *NetWare 386* contains more management tools than *NetWare 286*. More importantly, several companies are on the verge of shipping *NetWare* loadable modules—programs that will run on the *NetWare 386* server and will monitor and report on every possible parameter of system operation. Unfortunately, however, they probably won't run in your *Advanced NetWare 286*, Version 2.*x*, server. This could mean an expensive software upgrade for you. If you're happy with the storage capacities of *Advanced NetWare 286*, I don't think you need to upgrade to *NetWare 386* just to gain management tools.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay you $50 for any tips we print. Please submit your letter on a disk along with a printout. Then, mail your contributions to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We're sorry, but we are unable to answer letters personally. ■

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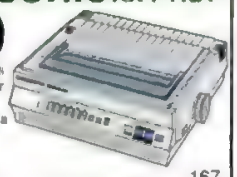

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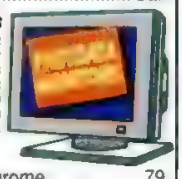

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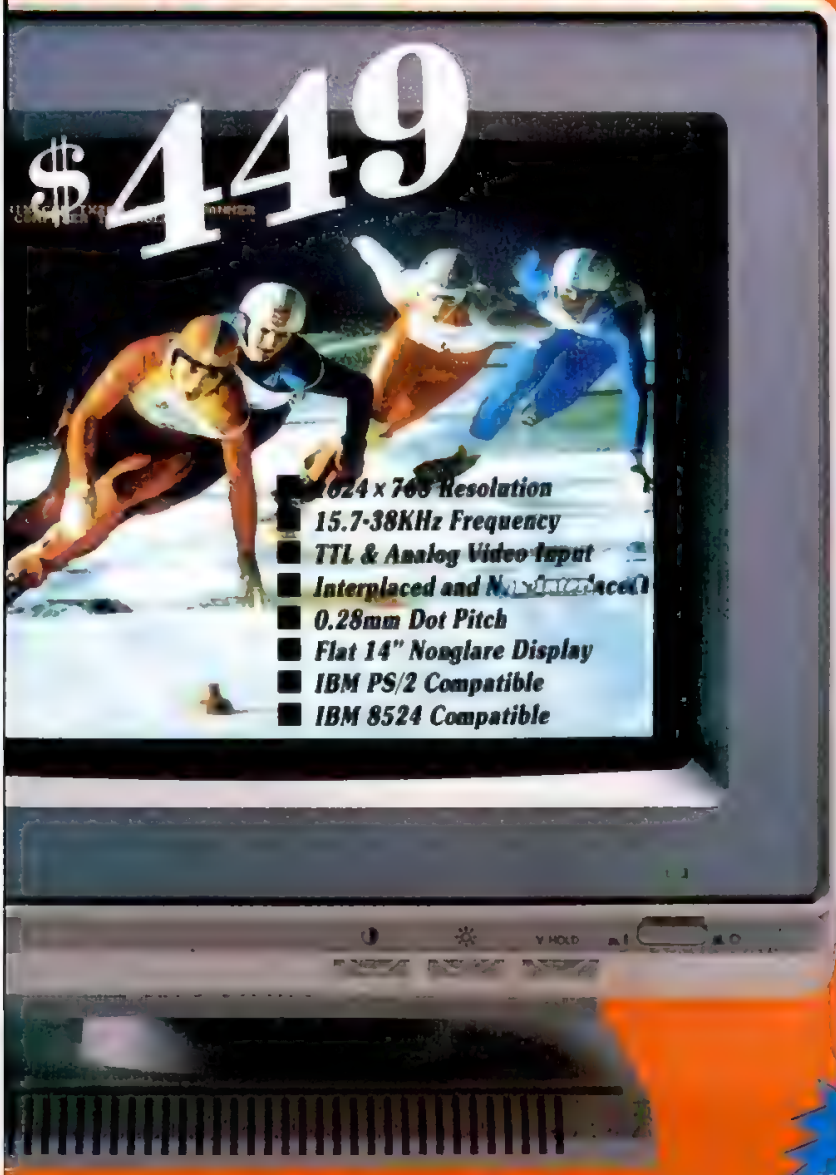

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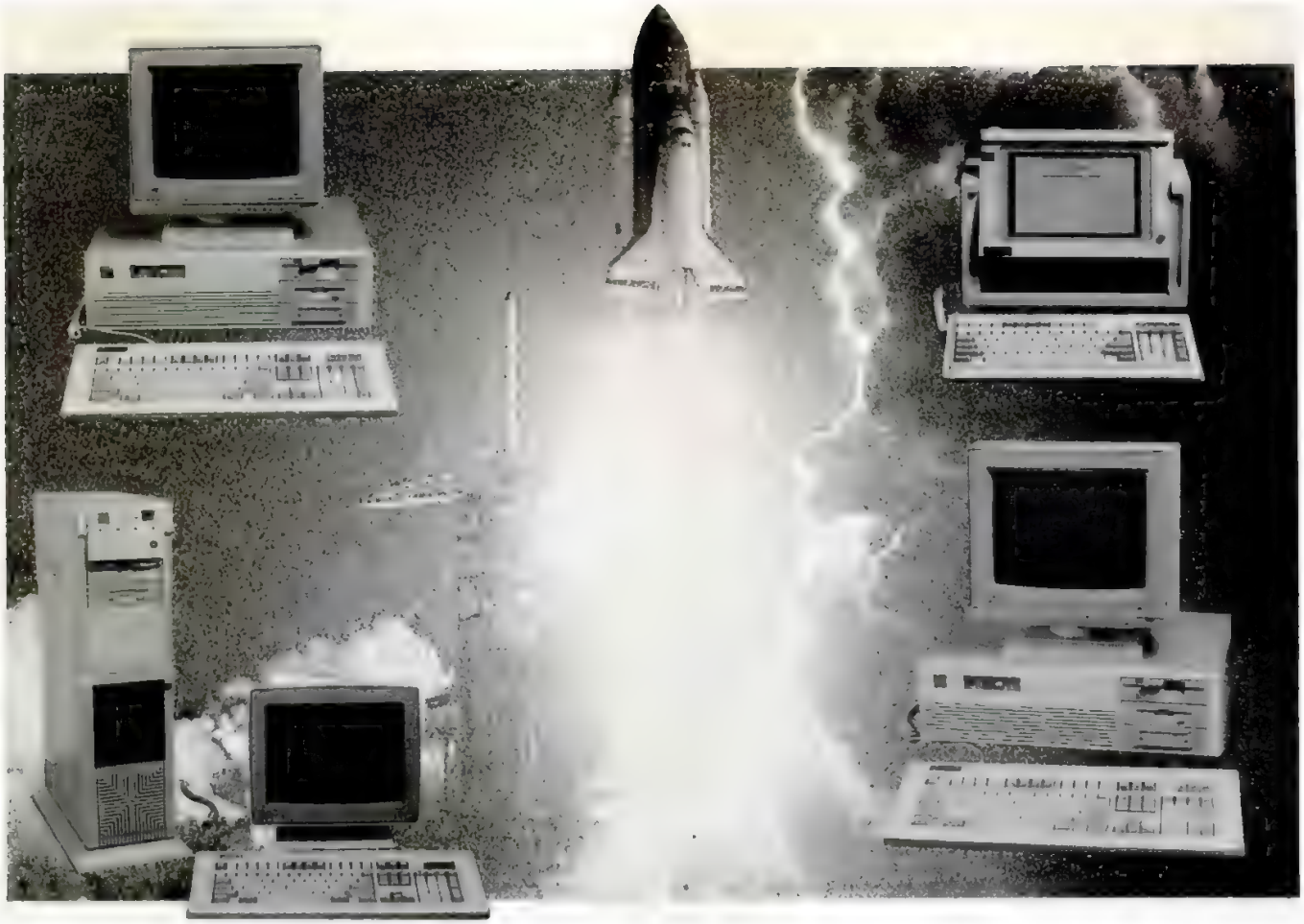

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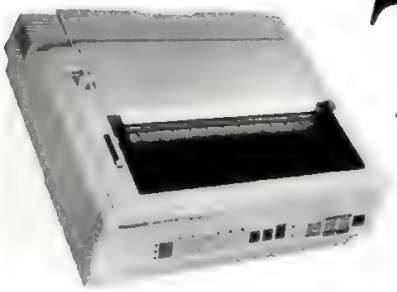

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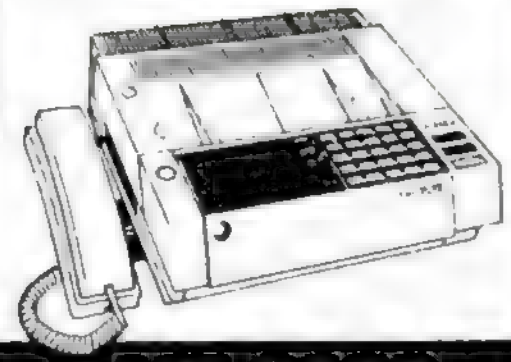

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LQ 850	474
LQ 950	474
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Boca VGA/VGA+	139/159

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external	859
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Toshiba 3200/3200SX	3395/4179
Toshiba 5200 40/100	4999/5389
Panasonic CF 150B	759

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ARC Net PC 130E	165
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Above systems include 1 meg., 1.2 floppy, HD controller

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8087-2	[illegible]
80287-8	[illegible]
80387-10	219
80387-16	339
80387-20	379
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80387-33	579
80387-SX	[illegible]
Simm Dram and Sipp	Call

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3D	629
4D	1199
5D	2350
IBM	
8503	219
8512	479
8513	579
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MAX15	Call
Ultra 16	[illegible]
Ultra 14	Call
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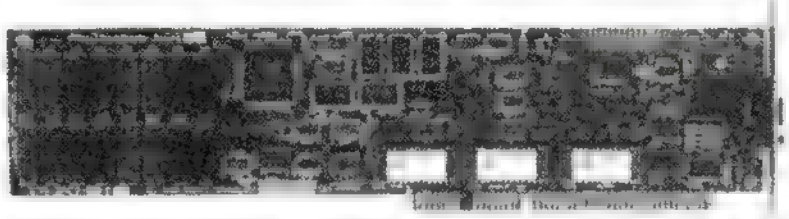

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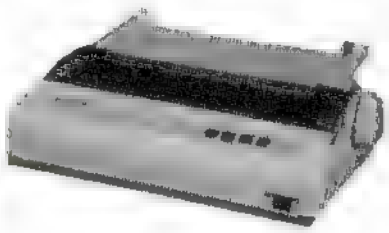

SL90

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Relisys 14" EGA monitor and EGA card package (720 x 350 max. resolution)
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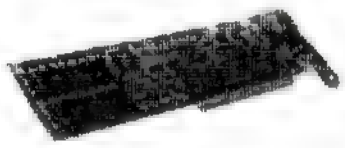

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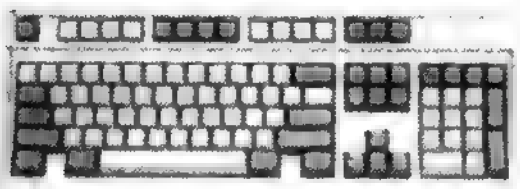
JE2061

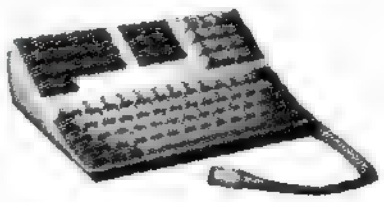
IBM PC/XT/AT Compatible Keyboards



FKB4700

JE2015	84-Key Standard AT Style Layout	$59.95
FKB4700	101-Key Enhanced Layout with 12 Function Keys	$69.95

MEI 100-Key Microtype Keyboard



- IBM PC/XT/AT/386 Compatible
- Saves an amazing 60% of the desk space used by equivalent standard keyboards

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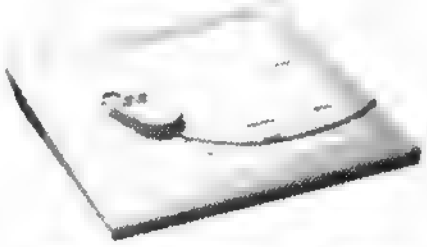

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- 400 dpi

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Modems

9600E Pictured

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511000P-10	100ns, 1 Megx1	$12.35

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UPD70108-5	5MHz, V20 Chip	$5.25
UPD70108-8	8MHz, V20 Chip	$6.95

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8087-2	(8MHz) 8086 & 8088	$129.95
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80287-8	(8MHz) 80286	$209.95
80287-10	(10MHz) 80286	$239.95
80387-16	(16MHz) 80386	$349.95
80387-20	(20MHz) 80386	$399.95

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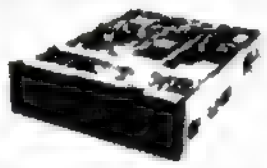

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Toshiba
356KU 3.5" 1.44Mb Internal Drive . $109.95

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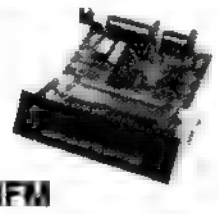

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M8425XT	20Mb (68ms) 3.5"HH (Kit)	$269.95
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SEAGATE	ST4096 80meg 28ms	558
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INTEL	80C287A	269
INTEL	80387SX	297
INTEL	80387-16	335
INTEL	80387-20	369
INTEL	80387-25	468
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KXP1624	425		
NEC			
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P5200	504	LC890XL/LC290	CALL
OKIDATA			
182 Turbo	225	380+	357
320/321	329/459	390+/391+	459/629
Laser 400	929	393+	969
STAR			
NX1000 II	169	XB2410	448
NX1000Rainbow	225	XB2415	CALL
EPSON			
FX-850	CALL	LQ-850	CALL
FX-1050	CALL	LQ-1050	CALL
LQ-510	CALL	LQ-2550	CALL
LQ1010	CALL	DFX-5000	CALL
DICONIX by Kodak			
150+	324	150+ CASE	29
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25-in-1 FONT CARTRIDGE	257
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PLOTTER-IN-CARTRIDGE	237

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MULTISYNC IIA	14" 800x600	475
MULTISYNC 3D	14" 1024x768	599
MULTISYNC 4D/5D	"NEW"	1124/2285
PACKARD BELL		
PB1474FA	14" Flat Monochrome	119
PB8531VG	14" VGA 640x480 .31 dot	369
PB8541VG	14" VGA 640x480 .41 dot	329
MITSUBISHI	14" 1381 DIAMONDSCAN	489
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- With Tilt-Swivel Base

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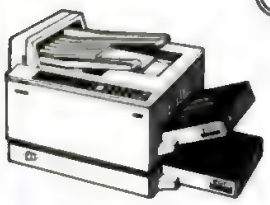

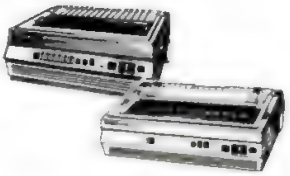

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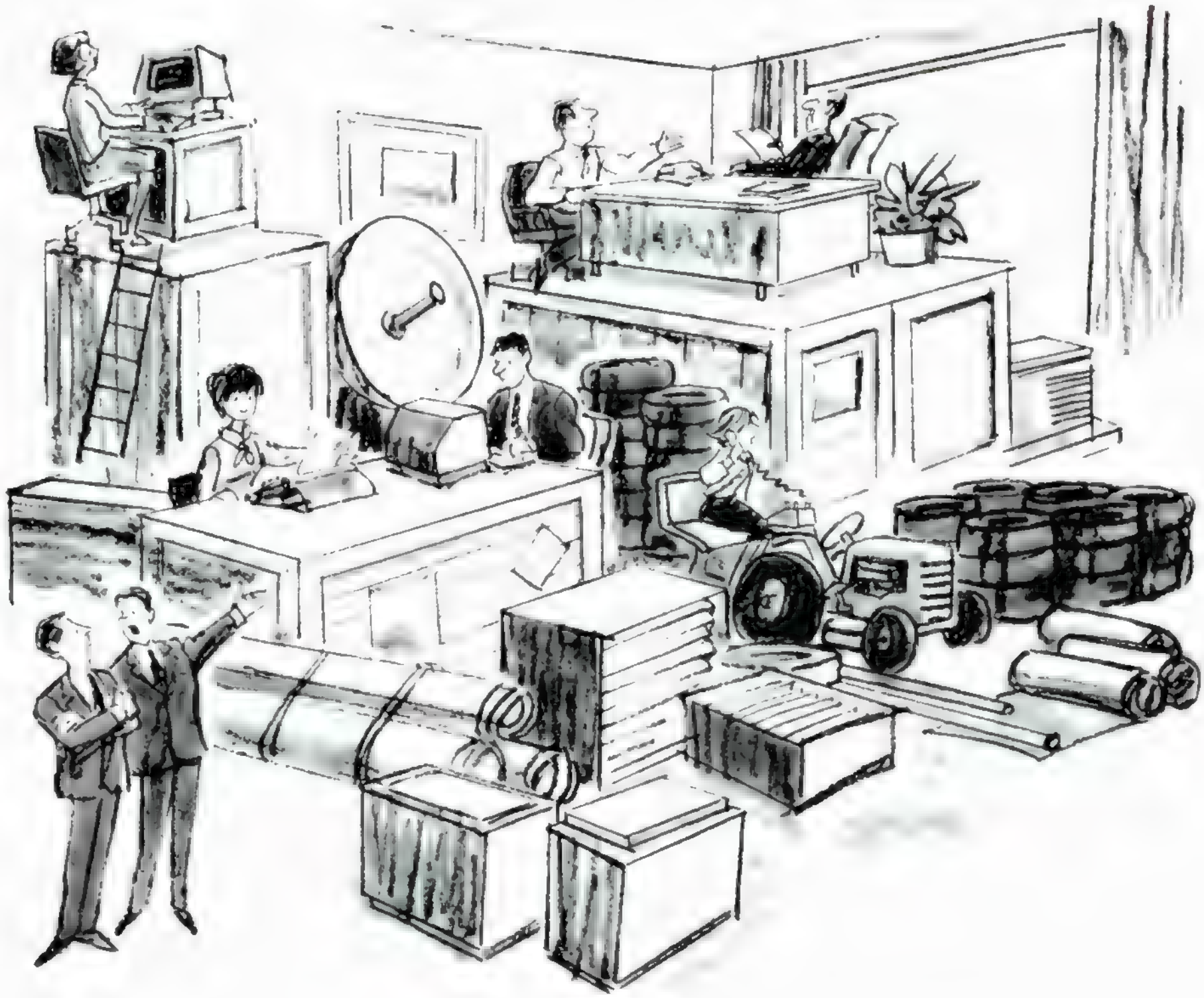

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PRODUCT CATEGORIES

HARDWARE

Add-On-Boards 421
CD-ROM 423
Communications 423
Computer Systems 427
Disk Drives 429
Diskettes 429
Expansion Units 430
Input Devices 430
Peripherals 430
Plotters 432
Power Supplies 432
Printers 432
Security 432

SOFTWARE

Accounting 432
Business 433
Business Project Mgmt 433
Business Time Mgmt 433
Communications 433
Construction 433
Data Base 434
Data Entry 434
Desktop Publishing 434
Education 434
Engineering 435
Entertainment/ Games 435
Financial 435
Flowcharting 435
Graphics 436
Health 436
Inventory 436
Languages 437
Mailing Programs 437
Medical 437
Music 437
Preventative Maintenance 438
Programmers Tools 438
Public Domain/ Shareware 438
Real Estate 439
Religion 439
Sales Marketing 439
Scientific 439
Security 440
Statistics 441
Surveys 441
Utilities 441
Word Processing 442

MISCELLANEOUS

Accessories 442
Bar Coding 442
Books/Catalogues/ Publications/ 444
Computer Insurance 444
Data Conversion 444
Data Recovery Services 444
Disk Conversion 444
Diskette Copy Service 445
Supplies 445

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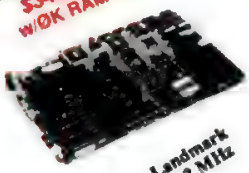

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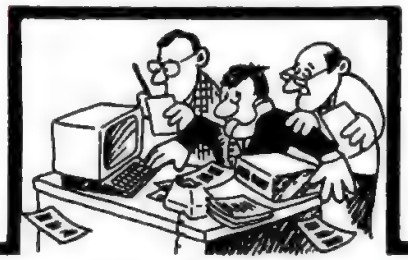

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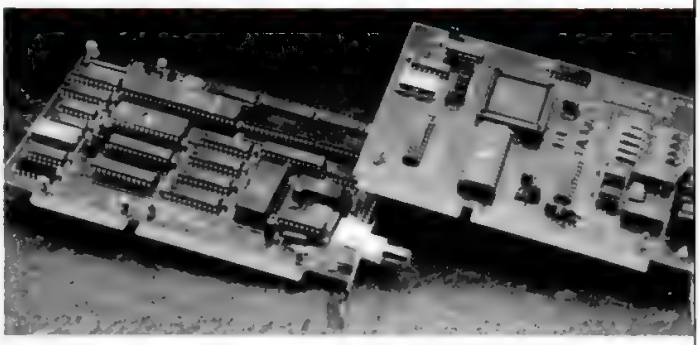

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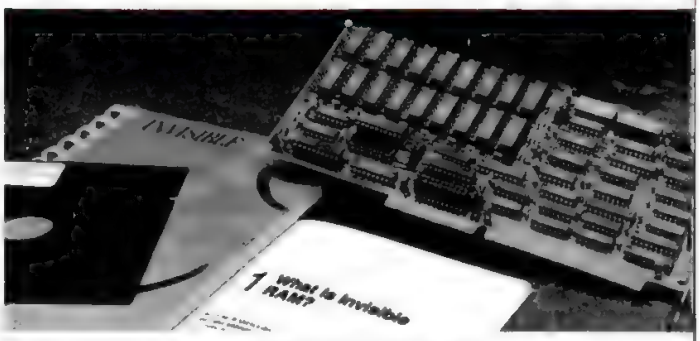

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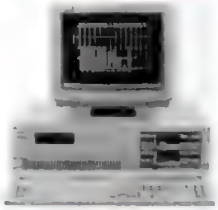

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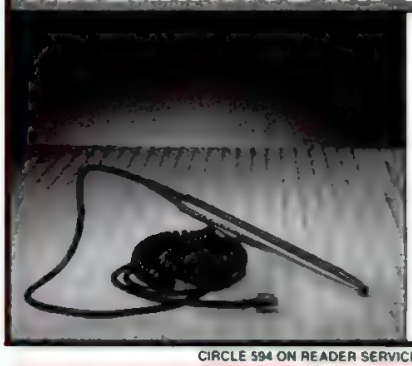

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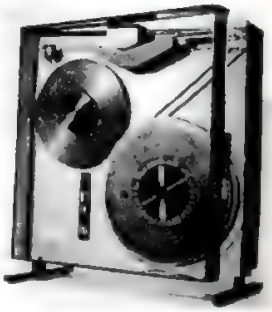

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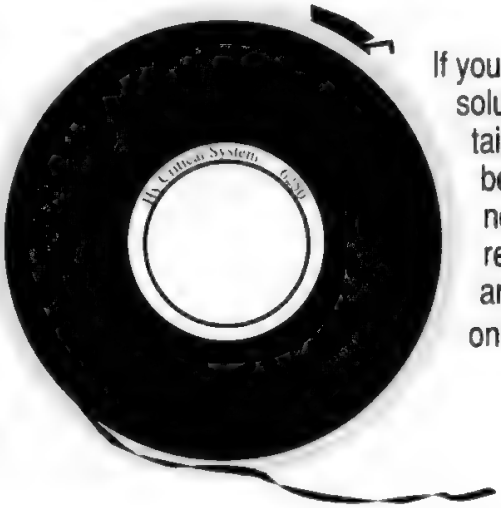

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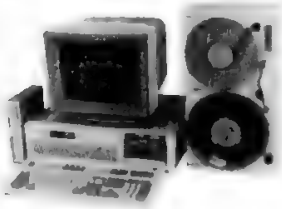

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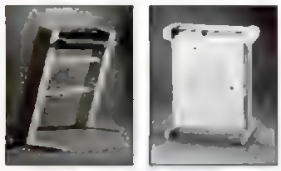

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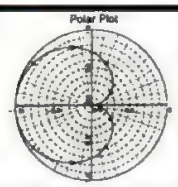

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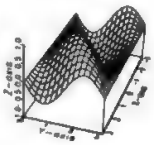

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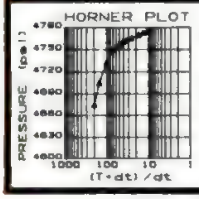

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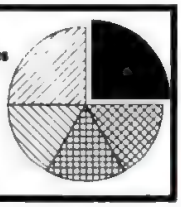

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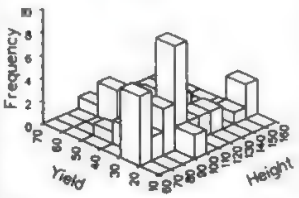

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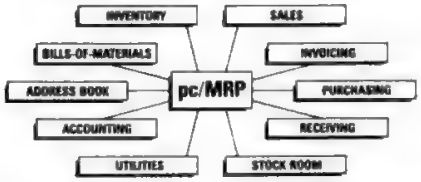

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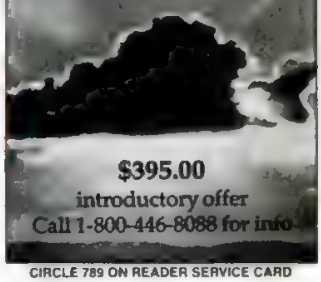

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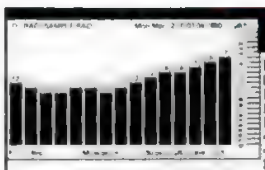

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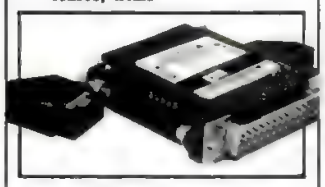

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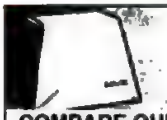

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EDITORIAL PRODUCT INDEX

READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE
AFTER HOURS			
416	Crime Wave	Access Software	451
420	Health Database Plus	CompuServe	453
419	Hole-in-One Miniature Golf	Digitek Software	453
417	Knights of Legend	Origin Systems Inc.	452
418	Qix	Taito Software Inc.	452
COMMUNICATIONS			
624	BLAST RemoteControl, Version 9.0	Communications Research Group	296
625	Carbon Copy Plus, Version 5.2	Microcom Software Division	297
626	Close-Up, Version 3.0A	Norton-Lambert Corp.	299
627	Co/Session, Version 4.0	Triton Technologies Inc.	301
628	pcAnywhere III, Version 3.11A	Dynamic Microprocessor Associates	301
629	Remote², Version 2.0A	Digital Communications Associates	306
630	Takeover, Version 1.0	SoftKlone Distributing Corp.	306
ENDURANCE TESTS (Scanners and Printers)			
SCANNERS			
421	Chinon DS-3000	Chinon America Inc.	246
422	Hewlett-Packard ScanJet Plus	Hewlett-Packard Co.	246
423	Kurzweil K-5100 Intelligent Scanning System	Xerox Imaging Systems/Kurzweil	306
PRINTERS			
545	AEG Olympia NP 136-24	AEG Olympia Corp.	270
424	Brother HL-8e	Brother International Corp.	249
425	Brother HL-8PS	Brother International Corp.	256
550	C. Itoh C-610	C-TECH Electronics Inc.	277
544	Hewlett-Packard DeskJet Plus	Hewlett-Packard Co.	270
426	Hewlett-Packard LaserJet IID	Hewlett-Packard Co.	256
427	Hewlett-Packard LaserJet IIP	Hewlett-Packard Co.	258
428	IBM LaserPrinter	IBM Corp.	265
546	IBM Proprinter XL24E	IBM Corp.	273
547	NEC Pinwriter P2200XE	NEC Technologies Inc.	274
548	Panasonic KX-P1124	Panasonic Communications & Systems Co.	274
543	QMS ColorScript 100 Model 10	QMS Inc.	266
429	QMS PS-2200 Model S	QMS Inc.	265
601	Star Micronics XB-2415 Multi-Font	Star Micronics America Inc.	282
549	Unisys AP 1324	Unisys Corp.	275
542	Varityper VT600W	Varityper Inc.	265
GRAPHICS			
432	PagePak, Business Volume 1	Marketing Graphics Inc.	49
HARDWARE			
620	CompuAdd HardCache/ESDI	CompuAdd Corp.	162
621	DPT SmartCache Controller model PM3011/75	Distributed Processing Technology	168
622	Konan TenTime TNT-2210	Konan Inc.	173
435	pcMAXimum Cosmos 600 optical storage unit	RACET Computes Ltd.	53
623	Perceptive Solutions hyperSTORE-1600	Perceptive Solutions Inc.	174
438	Proxima Data Display VersaColor	Computer Accessories Corp.	53
433	Stor/Mor	Q/COR	53
445	Stowaway 2400	Vocal Technologies Inc.	48
436	VIP PowerSave 500	ITT PowerSystems Corp.	53
LAPTOPS			
442	Sharp PC-6220	Sharp Electronics Corp.	33
PRINTERS			
402	Canon LBP-4	Canon USA Inc.	126
403	Dataproducts LZR 650	Dataproducts Corp.	126
404	Epson EPL-6000	Epson America Inc.	128
405	Facit P6060	Facit Inc.	133
406	Fujitsu RX7100	Fujitsu America Inc.	134
407	Hewlett-Packard LaserJet IIP	Hewlett-Packard Co.	139
408	Okidata OkiLaser 400	Okidata	140
409	Qume CrystalPrint Series II	Qume Corp.	143
410	Toshiba PageLaser6	Toshiba America Information Systems Inc.	146
SOFTWARE			
431	1-2-3/G	Lotus Development Corp.	33
443	Applications Manager	Intelligent Environments	43
448	Catchword	Logitech	46
605	ClassiFILE, Version 1.0	Soft Logic Solutions Inc.	188
444	db Publisher for Ventura	Digital Composition Systems	46
606	Direc-Tree Plus, Version 5.4	Micro-Z Co.	191
607	DOS Partner, Version 1.1	EasySoft Inc.	142
439	EtherVision	Triticom	53
608	HyperPAD, Version 1.0	Brightbill-Roberts & Co.	205
440	Image Wizard	Wang Laboratories Inc.	53
609	The Norton Commander, Version 3.0	Peter Norton Computing Inc.	210
610	PC-HookUP, Version 2.0	Brown Bag Software Inc.	217
446	PC-Tags for DOS, PC-Tags for OS/2	Moderne Software	48
611	PC Tools Deluxe, Version 6.0	Central Point Software Inc.	212
612	PowerMenu, Version 5.0	Brown Bag Software Inc.	218
613	Power Panel, Version 1.0	Mouse Systems Corp.	220
614	Q-DOS II, Version 2.0	Gazelle Systems	229
615	SoftBreeze, Version 3.0	SoftShell Systems	230
616	Tree86 Plus, Version 3.2	The Aldridge Co.	232
617	Treeview, Version 1.1	Magee	235
618	XTree Pro Gold, Version 1.31	XTree Co.	236
447	VI-Spy	RG Software Systems Inc.	49
UTILITIES			
437	Bootcon	Modular Software Systems	53
430	Control Room	Ashton-Tate	38
434	NW Utility Library	EMS Professional Shareware Libraries	53
441	PCED 2.0	The Cove Software Group	44

PRODUCTIVITY

DEPARTMENT	PROGRAM NAME/DESCRIPTION	PAGE
Lab Notes	EISA, the alternative to IBM's Micro Channel, promises high performance and maximum compatibility.	315
Utilities	MEMMAP, a Turbo Pascal program that displays all memory blocks allocated by DOS.	329
Environments	Writing programs that draw continuously calls for a different approach to multithreaded programming.	347
Power Programming	Some changes in the 32-bit API kernel indicate a shift toward C and away from assembly language programming.	359
Windows	Why DOS TSRs don't always work under Windows.	367
Windows	The implementation of MDI in future Windows programs will improve since new libraries and tools are available.	367
Databases	How to rename a FoxBASE program without recompiling it.	371
Databases	A routine that creates a unique variable name that you can use as a temporary filename.	371
Databases	How to quickly BROWSE a few records in a large database.	371
Databases	Clipper UDFIs can extend the power of Label and Report Forms.	371
Databases	Avoid SORT's limitations and space requirements by indexing.	371
Databases	dBASE IV safeguards JOINing two databases by setting EXACT when a query is issued.	371
Spreadsheets	How to identify printouts by time as well as date.	375
Spreadsheets	A macro that determines Lotus 1-2-3's version number.	375
Spreadsheets	Three ways to activate ranges other than using scroll bars.	375
The Working Word	Companion brings a command-driven interface to WordPerfect.	379
User to User	A batch file that lets DOS determine the day of the week.	379
User to User	Storing ANSI commands in mnemonic environment variables makes them easier to use.	381
Tutor	A simple procedure to import AutoCAD graphics into WordPerfect.	383
Tutor	How to determine whether a BIOS supports extended keyboard functions.	383
Tutor	How to write intelligent TSRs that know how to stay out of the way.	383
Connectivity	Increase performance with a caching disk controller.	395
Connectivity	Why some Compaq portables can communicate with a VAX.	395
Connectivity	Shells and menu programs provide monitoring functions for networks.	395

ADVERTISERS PRODUCT INDEX

RS#	ADVERTISER	PRODUCT	PAGE#
ACCOUNTING SOFTWARE			
•	Computer Associates	ACC Pac	317
•	DAC Easy, Inc.	Accounting Software	71
238	Global Computer Supplies	Versa Accounting	331-332
196	M-USA Business Systems, Inc.	Pacioli Software 2000	277
263	Macola Inc.	Accounting Software	303
358	Peachtree Software	Accounting Software	342
DATABASE MANAGERS			
•	Borland International	Paradox 3 0	370
178	Clarion Software	Professional Developer	57
339	Group 1 Software	ArcList	238
539	Microrim	RBase	144-145
253	Norick Data Systems	Picture File	273
•	Oracle	Database Management Software	76
199	Xtree-Div of Executive Systems	Xtree Pro Gold	163
INFORMATION MANAGERS			
117	Chronologic Corp.	Personal Info Manager Software	181
•	IBM Corp	Current	310-311
•	Lotus Development	Agenda	47
INTEGRATED SOFTWARE			
•	Microsoft	PC Product Software Line	72-73
LANGUAGES			
280	Lasergo Inc.	Go Script	4
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
OPERATING SYSTEMS/ENVIRONMENTS			
243	DSC Communications	DSC Nexos	259
•	IBM Corp	OS/2	193
724	Softlogic Solutions	Software Carousel	14
393	Software Link, Inc.	PC MOS/386	354
PROJECT MANAGEMENT			
169	Computer Aided Management	Viewpoint Project Mgmt Software	276
148	Primavera Systems	Project Management Software	59
STATISTICAL SOFTWARE			
103	SPSS, Inc	Statistical Software	91
TRAINING SOFTWARE/PUBLISHING			
238	Global Computer Supplies	Training Software Books	331-332
UTILITIES			
204	Avery	Labelpro Software	169
106	Better Software Technology	Switch It	324
328	Buffalo Products	Printing Utility	141
•	Central Point Software	PC Tools Deluxe	199-204
504/104	Datastorm Technologies Inc	Hot Wire	234
110	Easysoft, Inc.	DOS Partner	184
224	Franklin Software	Language Master	59
162	Gibson Research	Spinrite II	88
167	Helix Software	Headroom	83
280	Lasergo Inc.	Go Script	4
170	Multisoft Corporation	Super PC Kwik	56
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
302	Peter Norton Computing	DOS Utility-Commander	219
290	Rose Electronics	Master Link	355
724	Softlogic Solutions	Software Carousel	14
183	Westlake Data Corp	'PC Fullback Plus'	82
199	Xtree-Div of Executive Systems	Xtree Pro Gold	163
WORD PROCESSING SOFTWARE/AIDS			
•	Ashton Tate	Multimate	358
224	Franklin Software	Language Master	59
•	IBM Corp	Displaywrite	58
125	Intercon	Font Cartridges	149
325	IQ Engineering	IQ Super Cartridges	248
280	Lasergo Inc.	Go Script	4
•	Microsoft	General Word Processing Product Line	2-3
•	Microsoft	Working Model	378
•	Microsoft	PC Product Software Line	72-73
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
•	Wordperfect Corporation	Word Perfect 5 1	112
149	WYSIWYG	Word Processing Software	275
WORD PROCESSING SOFTWARE			
316	Zylab Corporation	Zy Index	16
CAD/CAM			
154	Mathsoft Inc.	PC CAD Version 2 5	39
143/134	Techno	Desktop CNC Milling Machine	284
ARTIFICIAL INTELLIGENCE			
182	Logitech	PC/All Product	55
SPREADSHEET/TEMPLATES			
•	Borland International	Quattro Pro	374
•	Computer Associates	Super Calc	264
•	Lotus Development	Lotus 123G	208-209
•	Microsoft	PC Product Software Line	72-73
DESK TOP PUBLISHING			
298	DP-Tek, Inc.	PS-600	70
125	Intercon	Font Cartridges	149
325	IQ Engineering	IQ Super Cartridges	248
280	Lasergo Inc.	Go Script	4
182	Logitech	PC/All Product	55
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
299	SWFTE International, Ltd	Glyphix	37
DATA ENTRY SOFTWARE			
362	OCR Systems	Read Right 2 01	247
FORM DESIGNERS			
257	Indigo Software Ltd	Jet Form	241
MAILING SOFTWARE			
339	Group 1 Software	ArcList	238
DESKTOP CAM MANUFACTURING			
143/134	Techno	Desktop CMC Milling Machine	284
MAPPING SOFTWARE			
221	Strategic Mapping Info	Mapping Software	120
FLOWCHARTING			
301	Patton & Patton	Flow Charting Software	282
124	Roykore, Inc.	Flowcharting	373
WINDOWS SOFTWARE			
124	Roykore, Inc.	Windows Software	373
COMPATIBLE KEYBOARDS			
•	Compu Add	Computer Accessories	349-352
179	Jameco Electronics	Compatible Keyboards	415
•	Northgate Computer Systems	Keyboards	194-197
101	Personal Computer Products Inc	Font Cartridges	284
388	Zeos International	Keyboard	74
DISK BACKUP & TAPE DRIVES			
•	Central Point Software	PC Tools Deluxe	199-204
216	Everex Systems, Inc	Floppy Tape	20
378	Iomega Corporation	Bernoulli Box	304-305
179	Jameco Electronics	40 & 100 Megabytes	415
317	Megadrive Systems, Inc.	Removable Hard Drives	127
240	Mountain Computer Inc.	Tape Backup	42
190	Procom Technology	Storage Peripherals	161
268	Swan Technologies/TCP	Tape Back-Ups	22-25
HARD DISKS			
162	Gibson Research	Spinrite II	88
•	Hard Drives International	Mail Order	418
317	Megadrive Systems, Inc.	Removable Hard Drives	127
190	Procom Technology	Storage Peripherals	161
•	Seagate	Hard Disk Drives	215
314/161	Storage Dimensions/Maxtor	Laser Stor	283
737	Vicon Corporation	Miniscribe, Maxtor	419
COMPUTERS/COMPATIBLES			
485	ACMA Computers, Inc.	Mail Order	318-319
165	Advanced Logic Research	PC's	32
107	AGI	Systems	189
166	AST Research	386 SX	148
509	Austin Computers	PC's	9-10
155	Canon, USA	Navigator	65
109	Comp Discount Warehouse (MMC)	Mail Order	413
•	Dataworld	PC's	18-19
536	Dell Computer Corporation	Dell PC's	C5-8
532	Dell Computer Corporation	Dell PC's	260-263
383	DR Discount Computers	Computers/Compatibles	328
102	DTK Computers	PC Systems	213
•	Excel Micro	Computers/Compatibles	412
373	Gateway 2000	Compatibles	182-183
364	Gateway 2000	Compatibles	129-132
525	Hyundai	PC's	160
179	Jameco Electronics	Computers/Compatibles	415
526	NCR Corporation	NCR PC's	66-67
•	Northgate Computer Systems	Credit Card	231
•	Northgate Computer Systems	Keyboards	194-197
•	Northgate Computer Systems	Technical Support	40-41
•	Northgate Computer Systems	Compatibles	150-151
•	Northgate Computer Systems	Compatibles	242-244
•	Northgate Computer Systems	Compatibles	334-336
168	Olivetti	Olivetti 286	26
271	Pao-Ku Ltd.	Mail Order	411
303/308	PC Brand	Compatibles	285-287
309/304	PC Brand	Compatibles	288-289
310/311	PC Brand	Compatibles	290-291
306/307	PC Brand	Compatibles	292-294
366	Samsung Information Systems	Computers/Compatibles	346
163	Standard Computer (CPU)	PC's	50-51
•	Sun Moon Star	Sun Moon Star 386 SX	12-13
268	Swan Technologies/TCP	Computers	22-25
391	Tangent Computer, Inc.	Tangent 33 & 20 MHZ 386's	121
206/123	Telemart	PC's	84-87
121	Tri-Star Computer	PC's	17
367	Universal Data Systems	V.3225	394
737	Vicon Corporation	Vicon Computers	419
350	WLT PC Express	Computers/Compatibles	164-167
211	Xircom	Ethernet Adapter Cards	187
•	Zeos International	Compatibles	48a-h
115	Zeos International	Z-Card	393
269	Zeos International	Compatibles	30-31
721	Zeos International	Compatibles	322-323
388	Zeos International	Keyboard	74
•	Zeos International	Portable	385-392
INPUT DEVICES			
187	Canon, USA	Scanners	240
179	Jameco Electronics	Digitizing Tablet, Scanner & Mice	415
492	KYE International	Mouse	172
182	Logitech	PC/All Product	55
•	Microsoft	Mouse	268-269
MULTIFUNCTION BOARDS			
356	Boca Research Inc.	Add In Board	90
113	Everex Systems, Inc	Memory Multifunction	298
ADD-ON BOARDS			
202	Amkly	Memory Board Simm	169
356	Boca Research	Add In Board	90
298	DP-Tek, Inc.	PS-600	70
325	IQ Engineering	IQ Super Cartridges	248
370	Micron Technology	Memory Boards	158
268	Swan Technologies/TCP	VGA Boards	22-25
737	Vicon Corporation	Chicory Motherboards	419

RS#	ADVERTISER	PRODUCT	PAGE#
SCANNERS/DIGITIZERS			
318	Chinon	Scanner	60
492	Kye International	Scanner	172
492	Kye International	Digitizer Tablet	172
PRINTERS			
242	Alps America	Allegro 500 Printer	147
204	Avery	Labelpro Software	169
328	Buffalo Products	Printing Utility	141
471	Canon, USA	Printers	152
332	Dataproducts	Printer	135
298	DP-Tek, Inc.	PS-600	70
363	Eastman Kodak (copy products)	Printers	341
491	Hewlett Packard-Peripheral Group	Galaxy	177-179
125	Intercon	Font Cartridges	149
325	IQ Engineering	IQ Super Cartridges	248
179	Jameco Electronics	Seikosha 9 & 24 Pin	415
280	Lasergo Inc.	Go Script	4
•	NEC Technologies	Printers	62
235	Okidata	Okidata Laser Printers	118-119
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
122	Panasonic Office Automation	Personal Laser Printer	362
259	QMS	Laser Printers	5
290	Rose Electronics	Master Link	355
193	Sharp Electronics Corp	Personal Laser Printer	267
348	Star Micronics	Printers	308
353	Texas Instruments	Printers	278-281
737	Vicon Corporation	Hewlett Packard Laserjets	419
PRINTER RIBBONS			
238	Global Computer Supplies	Printer Ribbons	331-332
FLOPPY DISK DRIVES			
190	Procom Technology	Storage Peripherals	161
173	Sysgen	Bridge File	239
FONT CARTRIDGES			
125	Intercon	Font Cartridges	149
PRINTER ACCESSORIES			
328	Buffalo Products	Printing Utility	141
298	DP-Tek, Inc.	PS-600	70
125	Intercon	Font Cartridges	149
325	IQ Engineering	IQ Super Cartridges	248
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
290	Rose Electronics	Master Switch	355
290	Rose Electronics	Master Link	355
PORTABLE/LAP COMPUTERS			
335	NEC Home Electronics Inc	Laptops	78-79
252	Panasonic OA	Laptop	157
•	Toshiba of America	Laptop	221-228
211	Xircom	Ethernet Adapter Card	187
•	Zeos International	Portable	385-392
PC-FAX			
155	Canon, USA	Navigator	65
231	Touchbase Systems	Portable Fax & Data Modem	28
210	Zoom Telephonics Inc.	Fax	21
CO-PROCESSORS			
747	Cyrix Corp	Fasmath	326-327
179	Jameco Electronics	Math Co-Processors	415
737	Vicon Corporation	Math Co-Processors	419
OPTICAL PERIPHERALS			
190	Procom Technology	Storage Peripherals	161
314/161	Storage Dimensions/Maxtor	Laser Stor	283
MEMORY SUBSYSTEMS			
190	Procom Technology	Storage Peripherals	161
CD-ROM			
190	Procom Technology	Storage Peripherals	161
DISPLAYS/MONITORS/TERMINALS			
324	Amdek	Monitors	321
329	Compeq U.S.A. (Vertex Systems)	VGA Monitor	257
•	Magnavox	Monitors	171
153	NEC Home Electronics Inc	3-D Multisync Monitors	C2-4, pl
138	Panasonic OA	C1381 Monitor	345
737	Vicon Corporation	VGA Monitors	419
GRAPHICS SOFTWARE			
729	Corel Systems	Corel Draw	190
•	Microsoft	PC Product Software Line	72-73
362	OCR Systems	Read Right 2.01	247
PLOTTERS/CHARTING DEVICES			
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
VIDEO GRAPHICS/BOARDS			
356	Boca Research	Add In Board	90
370	Micron Technology	Video Products	158
ACCELERATOR BOARDS			
•	Compu Add	Hard Cache Controller	155
COMMUNICATIONS SOFTWARE			
328	Buffalo Products	Printing Utility	141
•	Central Point Software	PC Tools Deluxe	199-204
504/104	Datastorm Technologies Inc	Procomm Plus	234
278	DCA	Crosstalk for Windows	52
•	Microcom Software	Carbon Copy	233
290	Rose Electronics	Master Net	355
735	Triton Technologies	Communications Software	309
LOCAL AREA NETWORKING			
293	3 COM	Local Area Networking	338-339
254	Artisoft	LAN Software	307
135	AT&T Data Systems Group	Data Systems Group	124-125
328	Buffalo Products	Printing Utility	141
•	DCA	Irma 3	271
147	DCA	Irma 3	272
243	DSC Communications	DSC Nexos	259
290	Rose Electronics	Master Switch	355
290	Rose Electronics	Master Net	355
230	US Sage	Main LAN	237
211	Xircom	Ethernet Adapter Card	187
MICRO-MAINFRAME LINKS			
293	3 COM	Micro-Mainframe Links	338-339
MODEMS			
179	Jameco Electronics	Modems	415
231	Touchbase Systems	Portable Fax & Data Modem	28
210	Zoom Telephonics Inc.	Modems	21
EMULATORS/PROTOCOL CONVERTORS			
241/297	Pacific Data Products, Inc.	Pacific Page	136-138
MULTIUSER SYSTEMS			
290	Rose Electronics	Master Link	355
230	US Sage	Main LAN	187
DISKETTES			
238	Global Computer Supplies	Diskettes	331-332
FURNITURE			
238	Global Computer Supplies	Furniture	331-332
POWER PROTECTION			
•	Curtis Manufacturing	Surge Protectors	117
238	Global Computer Supplies	Compu-Gard	331-332
•	Kensington Microware Ltd.	Masterpiece	216
PC ACCESSORIES			
238	Global Computer Supplies	PC Accessories	331-332
TRAINING/SEMINARS			
222	Addison-Wesley Pub Co.	Book	68
MAIL ORDER			
485	ACMA Computers, Inc.	Mail Order	318-319
336	Arlington Computer Products	Mail Order	403
481	Bull Dog Computer Products	Mail Order	414
273	Bus Computer	Mail Order	401
109	Comp. Discount Warehouse (MMC)	Mail Order	413
•	Compu Add	Computer Accessories	155
205	Compuclassics	Mail Order	404
300	Computability	Mail Order	405
536	Dell Computer Corporation	Dell PC's	C5-8
532	Dell Computer Corporation	Dell PC's	260-263
•	DGR Technologies Inc.	Bottom Line Distribution	408
383	DR Discount Computers	Mail Order	328
347	Dustin Discount Software	Mail Order Software	80
•	Excel Micro	Computers/Compatibles	412
352	Fastmicro	Mail Order	398-399
364	Gateway 2000	Compatibles	129-132
373	Gateway 2000	Compatibles	182-183
238	Global Computer Supplies	Computer Products	331-332
•	Hard Drives International	Mail Order	418
179	Jameco Electronics	Mail Order	415
225	Micro Warehouse	Mail Order	312-314
489	Midwest Computer Works	Mail Order	416
541	Misco USA	Mail Order	45
•	Northgate Computer Systems	Credit Card	231
•	Northgate Computer Systems	Keyboards	194-197
•	Northgate Computer Systems	Technical Support	40-41
•	Northgate Computer Systems	Compatibles	150-151
•	Northgate Computer Systems	Compatibles	242-244
•	Northgate Computer Systems	Compatibles	334-336
271	Pao-Ku Ltd.	Mail Order	411
303/308	PC Brand	Mail Order	285-287
309/304	PC Brand	Mail Order	288-289
310/311	PC Brand	Mail Order	290-291
306/307	PC Brand	Mail Order	292-294
•	PC Connection	Mail Order	250-255
474	Phoenix Computer Corporation	Mail Order	402
295	RP Systems	Mail Order	400
349	S&W Computers	Mail Order	419
163	Standard Computer (CPU)	PC's	50-51
206/123	Telemart	Mail Order	84-87
515	Tiger Software	Mail Order	92-111
268	Tussey Computer Products	Mail Order	22-25
737	Vicon Corporation	Mail Order	419
171	Warehouse Data Products	Mail Order	406-407
269	Zeos International	Compatibles	30-31
•	Zeos International	Portable	385-392
115	Zeos International	Z-Card	393
•	Zeos International	Compatibles	48a-h
721	Zeos International	Compatibles	322-323
388	Zeos International	Keyboard	74
ON LINE DATABASE			
226	Compuserve Information Service	On-Line Service	300
•	Dow Jones Information Services	Dow Jones Retneval	29
497	PC Magnet	On Line Database	446
MAINFRAME HARDWARE			
•	IBM Corp	AS400	364-365
MISCELLANEOUS			
221	Strategic Mapping Info	Mapping Software	120
143 134	Techno	Desktop CNC Milling Machine	284
DIRECT MARKETING CONNECTION			
336	Arlington Computer Products	Mail Order	403
481	Bull Dog Computer Products	Mail Order	414
273	Bus Computer	Mail Order	401
109	Comp. Discount Warehouse (MMC)	Mail Order	413
205	Compuclassics	Mail Order	404
300	Computability	Mail Order	405
•	DGR Technologies Inc.	Mail Order	408
•	Excel Micro	Mail Order	412
352	Fastmicro	Mail Order	398-399
•	Hard Drives International	Mail Order	418
179	Jameco Electronics	Mail Order	415
489	Midwest Computer Works	Mail Order	416
271	Pao-Ku Ltd	Mail Order	411
474	Phoenix Computer Corp	Mail Order	402
295	RP Systems	Mail Order	400
349	S&W Computers	Mail Order	419
737	Vicon Corporation	Mail Order	419
171	Warehouse Data Products	Mail Order	406-407

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COMING UP

■ THE BUS WARS: EISA vs. ISA vs. MCA

Contributing editor Winn L. Rosch sets the record straight about the PC bus architecture battle. Your best investment may be different than you thought; we'll give you the scoop on performance as well as strategic buying decisions for the months ahead. Look for tests from both PC Labs in New York and PC LAN Labs in Florida to demystify the true performance difference among EISA, ISA, and MCA.

■ FLAT-FILE DATABASES FOR QUICK SEARCHES

More than just glorified mailing list managers, today's flat-file database packages have increasingly sophisticated features that make them just right for a variety of data-handling applications. Not to worry, though. Ease of use is still their strong suit. Two of the packages even have graphical interfaces. Richard Hale Shaw evaluates *PC-File*, *Professional File*, *Q&A*, *RapidFile*, *Reflex*, and *Superbase 2*.

■ THE BEST UTILITIES OF ALL TIME

PC Magazine's editors select an essential software shelf of utilities: disk and memory diagnostics, DOS shells and menuing systems, file format converters, screen grabbers, network-setup aids, security programs, keyboard enhancers, file compressors, disk optimizers, text retrievers, remote communicators, and more. These are the very best products in the major utility categories.

■ LAN ANALYZERS

Local area network analyzers come in all shapes, sizes, and prices, and choosing the best one for your network gets more and more difficult all the time. PC Labs tests a wide variety of hardware and software products to put this complicated market into perspective. ■

After Hours

Products for the Leisure Side of Personal Computing

Adventure Meets Arcade In Access Software's Fast-Paced Crime Wave

GAMES
by Don Trivette

What do you get when you cross an adventure game with an arcade game? *Crime Wave*. This latest thriller from Access Software has a plot like an adventure game and all the shoot 'em up action of an arcade classic. If that's not enough to get you to pull the box off the shelf, consider that *Crime Wave* uses stunning VGA graphics of nearly photographic quality and, of course, Access's sound system (RealSound), which makes an ordinary PC sound like it has a $200 music card.

Crime Wave maintains the high standards Access Software has set for near-photographic-quality graphics.

As the story unfolds—or rather flashes by in animated cells—Mr. King Pin, boss of a nationwide crime cartel, kidnaps the President's daughter and hauls her off to a secret warehouse. It is your job to rescue her and in the process rid our cities of the drugs and thugs that Mr. Pin controls. Sandwiched between storyboards describing the plot are intense episodes of arcade action, where you'll battle the likes of Eddie The Lump, the Evil Ninja, and K909.

You are not defenseless. Armed with weapons, including a five-shots-at-once machine gun and an awesome rocket launcher, and protected by a powerful shield, you make your way deeper and deeper into the infested town. Ammo, your shield, and lives are all renewable resources. The first two can be scooped up as they drop from the top of the screen (heaven?), and the latter are stashed in various places around the city.

The arcade action ranges over a variety of different settings. The play begins in a railroad yard (watch out for snipers in the coaches), and moves on through a ghetto, a weapons plant, a drug factory, a subway station, and finally ends up in King Pin's mansion. Along the way, doors lead into dark and dangerous bonus rooms where laser beams and kinetic death pads present puzzles and obstacles you must overcome if you are to complete the rescue. Don't skip the bonus rooms, since they contain some useful supplies.

In addition to the 3,000 points you get for surviving each bonus room, other points are awarded for blowing away various villains like Eddie T. Lump, who counts for a measly 500, and The King Pin himself, who goes for a cool 25,000.

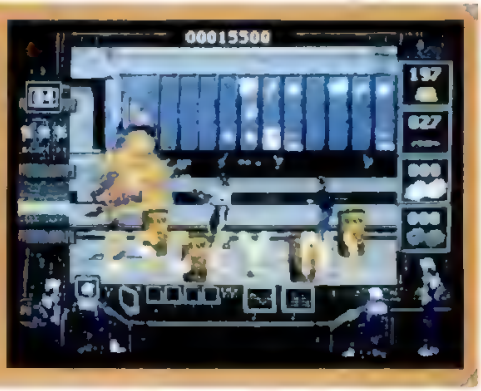
Crime Wave keeps score, allowing you to save your name and points after successfully completing the game. *Crime Wave* will not, however, allow you to save anything else, such as a game in progress, which means you'll have to complete your rescue in one sitting. That's just one of several inconveniences I found in an otherwise excellent product. The others: it doesn't support joysticks, it requires a hard disk, and it can be ridiculously slow on a slow computer (although you can choose to play a subset of *Crime Wave* that includes just the arcade action).

Once you master the beginner's level of play, you progress to two more-difficult levels. At the novice level, you may be attacked by only three or four gangsters at once. Ammo floats down at a slow rate, and you can take many hits before you expire. At the most difficult level, you must fight off waves of attackers. Supplies seem to be hurled at you too rapidly to scoop up, and one or two hits can do you in.

From the first notes of *Crime Wave*'s opening music (you'll swear it's Pink Floyd, but it isn't) to the last animated scene on a tropical island, you'll be astonished at how far computer games have come since the early hit, *Pong*. With its breathtaking graphics and surprisingly good sound—which requires no additional hardware—*Crime Wave* is a worthy addition to Access's series of state-of-the-art games. If you have a hard disk drive and a VGA or EGA card, this is a game you'll want to own.

List Price: *Crime Wave*, $59.95. **Requires:** 640K RAM, EGA or VGA graphics adapter, color monitor, hard disk, DOS 2.0 or later. Access Software, 545 W. 500 S., Bountiful, UT 84010; (800) 824-2549.

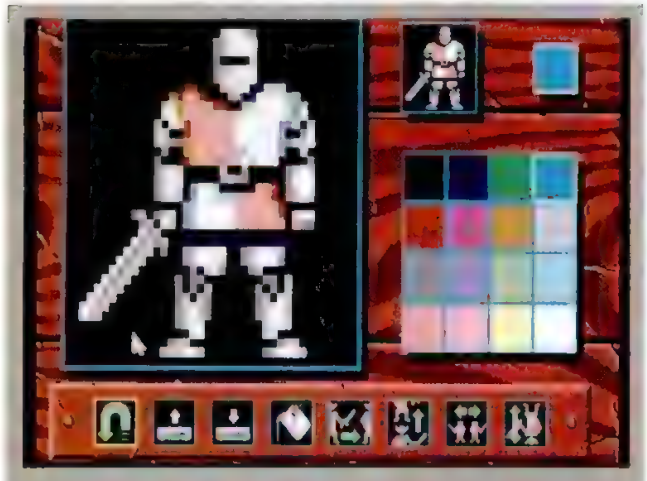
CIRCLE 416 ON READER SERVICE CARD



Crime Wave's arcade screens aren't as visually stunning as the game's dramatic sequences.

Origin Debuts An EGA-Based Adventure Game

The latest computerized fantasy kingdom to put out the call for software heroes is Ashtalarea, a sprawling piece of pseudomedieval real estate developed by Origin Systems. It's the setting for *Knights of Legend*, which pits your team of six characters (chosen from among two genders, four races, and 27 backgrounds) against the Dark Lord Pildar and his depraved allies.



Knights of Legend allows you to customize the appearance of your character with a built-in graphics editor.

Unlike the games in SSI's *Forgotten Realms* series, there's no direct path you need to follow in *KOL* to keep the plot moving. You're free to visit any of the many picturesque locations throughout charming Ashtalarea, while hacking, blasting, and slaying whenever you're attacked (which is frequently) along the way.

As with *Might and Magic*, there are a number of subsidiary quests, whose successful completion will help you win friends and influence people. And as in the *Ultima* series, words typed in at the keyboard trigger vital information from a computer-controlled persona.

One of *KOL*'s strongest suits is personality development. Town inhabitants reveal distinctive, well-drawn features and identities—beginning with Elmu Trollhewer, the Brettle Inn's dwarven host, whose face-splitting smile clearly belongs on a used-car salesman. EGA graphics throughout the game are good and sometimes stunning.

Combat options are varied, though no bonus points are awarded for sneak attacks. There are six weapon-mode and six hand-mode attacks, and six styles of defense to be used simultaneously. The action icons are commendably nonsexist, alternating male and female figures. Be warned, however: battles can take the better part of a real-time hour. Simple flesh wounds seldom kill opponents, and some of the sturdier ones must have the constitution of a grizzly bear.

Regrettably, there are several glitches in the game. The only significant one is in the "Quit to DOS" command, which is never discussed in the rulebook or reference card. You can leave the game without rebooting, but only outside shops or combat situations. First, you must save your characters' status in an inn. When asked if you want to quit, you must answer "No." (Answering "Yes" merely transfers you to the first game menu.)

Then you must reload a character, take him outside the inn, and hit Alt-Q. Quite an involved process to simply leave the game. Other problems are mere annoyances: occasional misspellings, for instance, or a certain spell that is listed at 700 gold pieces, but costs 900. (Ashtalarean inflation? These few bugs aside, *KOL* promises to be the initial release in a very successful series for Origin.

List Price: *Knights of Legend*, $49.95. **Requires:** 384K RAM, DOS 2.1 or later. Mouse optional. Origin Systems Inc., P.O. Box 161750, Austin, TX 78716; (512) 328-0282.

CIRCLE 417 ON READER SERVICE CARD

Qix Tests Your Reflexes As It Challenges Your Strategic Sense

GAMES
by Paul B. Ross

Hold down the Spacebar, press an Arrow key or flip your joystick, and suddenly you're traveling into your PC screen's uncharted interior, like the Starship Enterprise hurtling at full impulse power into the uncharted regions of space. Release the Spacebar and retire at near warp speed to the relative safety of the sidelines. You've just missed an encounter with the Qix, an unpredictable opponent cavorting about the screen, whose slightest touch means destruction.

The challenge and object of Taito Software's *Qix* are simple: *pacify* the interior. By maneuvering your cursor from the perimeter of the screen toward the center and back again, you rope off areas of the interior while staying beyond reach of what looks like a bunch of randomly moving multicolored pickup sticks (the Qix).

Each time you safely venture off the perimeter and back, you capture a portion of the screen and score points. At the same time, you create a new perimeter to traverse. However, once touched by the Qix (or their companion peril, the Spritz), your marker explodes. Four explosions and the game is over.

Why not just remain safely on the perimeter till you get a clear shot at scoring? Because the perimeter is a danger zone too. Starlike specs called Sparx dart around the perimeter after your marker. If they touch it, the marker explodes. But fill up 65 percent or more of the screen, and you're rewarded with bonus

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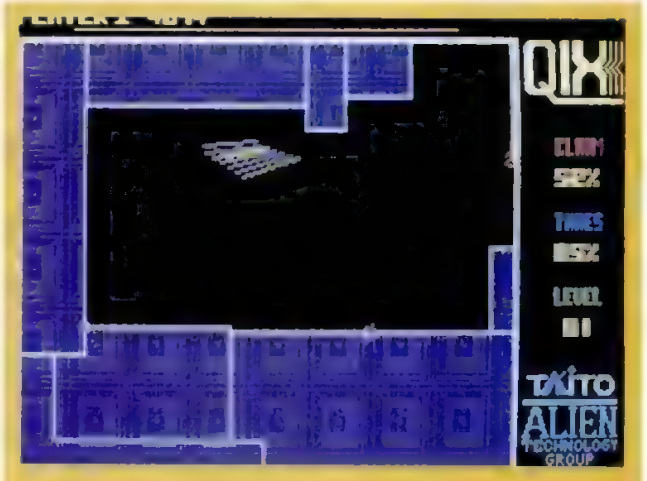

The object of *Qix* is to rope off portions of the PC screen while avoiding contact with the deadly *Qix*.

Qix

CONTINUED

points and a chance at another round with four new markers.

What's the catch? The number of perils increases, and soon you find yourself dodging not one but two sets of Qix. The animated how-to-play guide explains the basics well, but the dangers lurking in higher levels of play come as a surprise.

The animation and screen effects, by the way, are good. The Qix move wildly about the screen (at least they did on my Dell 16-MHz 386SX), and the colored patterns filling the conquered interior are all designer specials. The action is quick and suspenseful, whether you're using the keyboard or a joystick. When the action gets too quick, you can reach gratefully for the F1 key and pause the action.

Qix makes elaborate use of sound. Its opening score can be played out through the AdLib music card in gorgeous full-bodied stereo (assuming of course that you like the tune; it reminded me of bad disco music, and I just turned it off). Oddly enough, the music that punctuates each round of actual play bypasses the AdLib card in favor of the flat-sounding PC speaker. Taito did not follow through on the promise of the AdLib Card option.

Qix is great for hand-eye coordination, but don't buy it for so practical a reason. Buy it for the hold-your-breath suspense that creeps up on you as you battle the unpredictable Qix. Buy it for the satisfaction that comes from being able to master a random peril if your strategy and reflexes are up to it. There's very real pleasure in trapping the Qix in a colorful fill pattern.

List Price: *Qix*, $34.95.

Requires: 512K RAM; CGA, MCGA, EGA, VGA, or Tandy graphics adapter; DOS 2.1 or later. AdLib or CMS music card optional; joystick recommended. Taito Software Inc., 267 W. Esplanade, #206, N. Vancouver, B.C., Canada V7M1A5; (604) 984-3344.

CIRCLE 418 ON THE READER SERVICE CARD

Hole-In-One Offers A Wide Assortment of Loony Links

Miniature golf combines fantasy and frustration in almost equal proportions; through some alchemy of amusement, the result is pure entertainment. Electronic Arts' excellent *Zany Golf* sets the standard for PC-based mini-links by combining the familiar (castles, windmills) with the fantastic (a hole that duplicates the play of a pinball machine). *Hole-In-One Miniature Golf*, from Digitek Software, goes beyond *Zany Golf* by offering a far greater range of terrain and more options for game play.

Hole-In-One supports VGA graphics in the 256-color MCGA mode, and many of the holes are subtly drawn and shaded. Most of them, however, aren't quite as realistically rendered or humorously animated as *Zany Golf*'s EGA mode screens. To a certain extent, that's a matter of course design.

Both programs offer a "pinball" hole, for instance, in which you must get through a simulated pinball machine to reach the cup. *Zany Golf*'s version of the machine has working flippers and bumpers that light up when you hit them; it plays like real pinball. *Hole-In-One*'s pinball machine looks fine, but plays more or less like any other hole.

To be sure, many of *Hole-In-One*'s effects—such as tunnels with one entrance but many exits—are novel, amusing, and challenging. And while *Hole-In-One*'s graphics may not represent differences in elevation in a particularly realistic way, a contour view can be popped up when appropriate to show you the lay of a particular green.

Hole-In-One Miniature Golf includes a hole that simulates an old arcade-style pinball machine.

In some other respects, *Hole-In-One* leaves *Zany Golf* far behind. For one thing, Digitek's game comes with a whopping 90 holes, delivered on five 5.25-inch disks (or three 3.5-inch diskettes). There is a tutorial that requires a relatively low skill level, and courses that range from moderately difficult to nearly impossible. A "fantasy" course includes holes located under water, on busy city streets, or in the middle of the desert. This wide variety of play makes *Zany Golf*'s nine holes seem quite limited by comparison.

Zany Golf also has an annoying stroke limit for each hole; exceed the limit and you must start the game over. *Hole-In-One* imposes a stroke limit on each hole, but allows you to go on if you exceed it. *Hole-In-One*'s practice mode lets you make a mess of as many holes as you like without permanently recording the score.

Hole-In-One Miniature Golf offers hours of challenging fun to the serious miniature golf player. It's a perfect way to steal a few minutes of loony fun when deadlines loom and reality just doesn't seem interesting enough.

List Price: *Hole-In-One Miniature Golf*, $34.95.

Requires: 256K RAM (384K for VGA), graphics adapter, DOS 2.0 or later. Digitek Software, 8910 Dale Mabry Executive Center, #37, Tampa, FL 33614; (813) 933-8023.

CIRCLE 419 ON READER SERVICE CARD

CompuServe Has Health Info Database

PERSONAL FITNESS
by Don Trivette

To an already comprehensive assortment of health-related information, CompuServe has added *Health Database Plus*, a collection of articles and references about medicine, health, and fitness. The service is provided by Information Access company, a Ziff-Davis division known for *Computer Database Plus*, a database of computer periodical information.

HDP contains articles from three periodical groups. Health and fitness stories from 1,000 general-interest publications like *Ladies Home Journal*, *Good Housekeeping*, and *Playboy* make up the bulk of the database. A second group of 60 health-related publications, like *Prevention* and *Psychology Today*, supplements a third group of hard-core medical periodicals like the *Journal of the American Medical Association* and the *Journal of Pediatrics*.

Although 90 percent of *HDP* consists of full-text articles, the publications in the third group have been summarized with the lay reader in mind. Indeed, the contents of this database are geared to the average reader, fitness buff, or amateur hypochondriac.

The articles in *HDP* go back as far as 1986, and new articles are added weekly. At some point older articles will be purged, but that won't happen for several years. Currently there are 21,000 articles in the database.

To use *Health Database*, simply type GO HDB at the CompuServe prompt. After presenting you with preliminary

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INDEX TO ADVERTISERS

RS #	ADVERTISERS	PAGE
293	3 Com	338-339
485	Acma Computer	318-319
222	Addison-Wesley	68
165	Advanced Logic Research	32
107	AGI	189
242	Alps America	147
324	Amdek	321
202	Amkly	168
336	Arlington Computer Products	403
254	Artisoft	307
*	Ashton Tate	358
166	AST Research	148
135	AT & T Data Systems	124-125
509	Austin Computers	9-11
204	Avery	169
106	Better Software	324
356	Boca Research Inc.	90
*	Borland	374
*	Borland	370
*	Bottom Line	408
328	Buffalo Products	141
481	Bulldog Computer Products	414
273	Bus Computer	401
187	Canon USA	240
471	Canon USA	152
155	Canon USA	65
*	Central Point Software	199-204
318	Chinon	60
117	Chronologic Corp.	181
178	Clarion Software	57
329	Compeq USA (Vertex Systems)	257
*	CompuAdd	155
*	CompuAdd	349-352
205	Compuclassics	404
226	CompuServe	300
300	Computability	405
169	Computer Aided Management	276
*	Computer Associates	264
*	Computer Associates	317
109	Computer Discount Warehouse(MMC)	413
729	Corel Systems	190
*	Curtis Manufacturing	117
747	Cyrix Corp.	326-327
*	Dac Easy Inc.	71
332	Dataproducts	135
104/504	Datastorm Technologies	234
*	Dataworld	18-19
278	DCA	52
147	DCA	271-272
536	Dell Computer	C5-C8
532	Dell Computer	260-263
*	Dow Jones Info. Services	29
298	DP-Tek Inc.	70
383	DR Discount Computers	328
243	DSC Communications	259
102	DTK Computers	213
347	Dustin Discount Software	80
363	Eastman Kodak	341
110	Easysoft Inc.	184
216	Everex Systems	20
113	Everex Systems	298
*	EXCEL MICRO	412
352	FASTMICRO	398-399
224	Franklin Software	59
364	Gateway 2000	129-132
373	Gateway 2000	182-183
162	Gibson Research	88
238	Global Computer Supplies	331-332
339	Group 1 Software	238
*	Hard Drives Int'l.	418
167	Helix Software	83
491	Hewlett-Packard Peripheral Group	177-179
525	Hyundai	160
*	I.B.M. Corp.	58
*	I.B.M. Corp.	310-311
*	I.B.M. Corp.	193
*	I.B.M. Corp.	364-365
257	Indigo Software Ltd.	241
125	Intercon	149
378	Iomega	304-305
325	I.Q. Engineering	248
179	Jameco	415
*	Kennsington Microware	216
492	KYE International	172
280	Lasergo Inc.	4
182	Logitech	55
*	Lotus Development	47
*	Lotus Development	208-209
196	M-USA Business Systems	277
263	Macola Inc.	303
*	Magnavox	171
154	Mathsoft Inc.	39
317	Megadrive Systems	127
225	Micro Warehouse	312-314
*	MicroCom Software	233
370	Micron Technology	158
539	Microrim	144-145
*	Microsoft	2-3
*	Microsoft	268-269
*	Microsoft	72-73
*	Microsoft	378
489	Midwest Computer Works	416
541	Misco USA	45
240	Mountain Computer	42
170	Multisoft Corp.	56
526	NCR Corp.	66-67
153	NEC Home Electronics	C2-4
*	NEC Home Electronics	1
335	NEC Home Electronics	78-79
*	NEC Information Systems	62
253	Norick Data Systems	273
*	Northgate Computer Systems	231
*	Northgate Computer Systems	194-197
*	Northgate Computer Systems	40-41
*	Northgate Computer Systems	150-151
*	Northgate Computer Systems	242-244
*	Northgate Computer Systems	334-336
362	OCR Systems	247
235	Okidata	118-119
168	Olivetti	26
*	Oracle	76
297	Pacific Data Systems	136-137
241	Pacific Data Systems	138
122	Panasonic OA	362
252	Panasonic OA	157
138	Panasonic OA	345
271	Pau-Ku Ltd.	411
301	Patton & Patton	282
*	PC Brand	285
303/308	PC Brand	286-287
309/304	PC Brand	288-289
310/311	PC Brand	290-291
306/307	PC Brand	292-293
*	PC Brand	294
*	PC Connection	250-255
497	PC MagNet	446
358	Peachtree Software	342
101	Personal Computer Products Inc.	284
302	Peter Norton Computing	219
474	Phoenix Computer Corp.	402
148	Primavera Systems	59
190	Procom Technology	161
259	Q.M.S.	5
290	Rose Electronics	355
124	Roykore, Inc.	373
295	R.P. Systems	400
349	S & W Computers	419
366	Samsung Information Systems	346
*	Seagate	215
193	Sharp	267
724	Softlogic Solutions	14
393	Software Link, Inc.	354
103	S.P.S.S.	91
163	Standard Computer Corp.	50-51
348	Star Micronics	308
314/161	Storage Dimensions	283
221	Strategic Mapping Info	120
*	Sun Moon Star	12-13
299	SWFTE Int'l.	37
173	Sysgen	239
391	Tangent Computer Inc.	121
134/143	Techno	284
123/206	Telemart	84-87
353	Texas Instruments	278-281
515	Tiger Software	92-111
*	Toshiba of America	221-228
231	Touchbase Systems	28
121	Tri-Star Computer	17
735	Triton Technologies	309
268	Tussey Computer Products	22-25
367	Universal Data Systems	394
230	U.S. Sage	237
737	Vicon Corp.	419
171	Warehouse Data Products	406-407
183	Westlake Data	82
350	WLT PC Express	164-167
*	Wordperfect	112
149	Wysiwyg corp.	275
211	Xircom	187
199	X-Tree	163
*	Zeos Int'l.	48a-h
*	Zeos Int'l.	385-392
115	Zeos Int'l.	393
269	Zeos Int'l.	30-31
721	Zeos Int'l.	322-323
388	Zeos Int'l.	74
210	Zoom Telephonics Inc.	21
316	Zylab Corp.	16

* - No Reader Service #. Please call advertiser for information.

Health Database

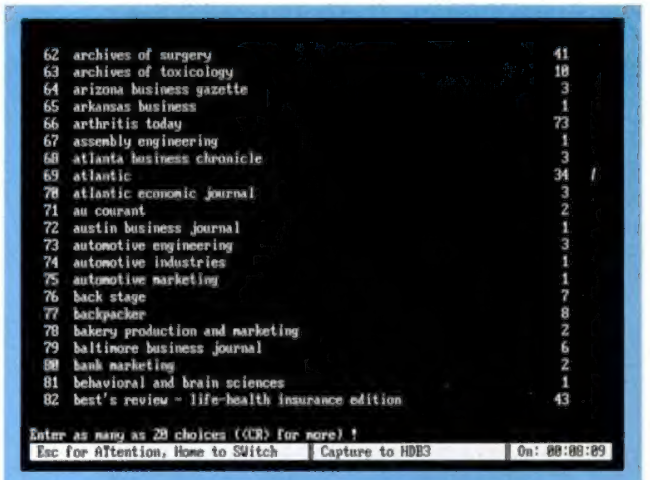
CONTINUED

instructions, including pricing information, the CompuServe computer in Ohio automatically switches you to a computer near Boston, where the data files are actually located.

HDP is a menu-driven retrieval system, so you don't have to learn a set of commands to find articles. Six menu choices let you search for information by (1) key word, (2) any word, (3) subject heading, (4) publication name, (5) publication date, and (6) article reference number. Once you've retrieved a preliminary list of articles, you can use another menu to either expand or contract the list to a manageable size, after which you can look at titles and print the articles that seem to best answer your query.

There are more than 1,500 articles on AIDS, for example, but when I narrowed the search to articles about AIDS and *kissing*, Health Database Plus turned up 28 matches including an excellent article in the November 20, 1989, issue of *CDC AIDS Weekly*, titled "The Biologic Possibility of HIV Transmission During Passionate Kissing." Other articles were from the *American Family Physician*, *Health*, and the *Saturday Evening Post*.

HDP isn't limited to information about diseases and medical anomalies; it includes some great articles on fitness, diet, nutrition, cross-training, and exercise. Of course the database cautions that it is no substitute for a physician, but in fact I got more of my general medical questions answered in an hour on *HDP* than I would have with a face-to-face chat with my doctor. And best of all, my bill was less than $20 and I didn't have to sit in a stuffy waiting room. ■



This screen shows a partial list of the 1,100 journals, magazines, and newsletters covered by *Health Database Plus*.

List Price: *Health Database Plus*. Standard CompuServe charges, plus 25 cents per minute and $1.50 for each full-text article retrieved.

Requires: CompuServe membership, communications software, modem. CompuServe, 5000 Arlington Center Blvd., Columbus, Ohio 43220; (800) 848-8199.

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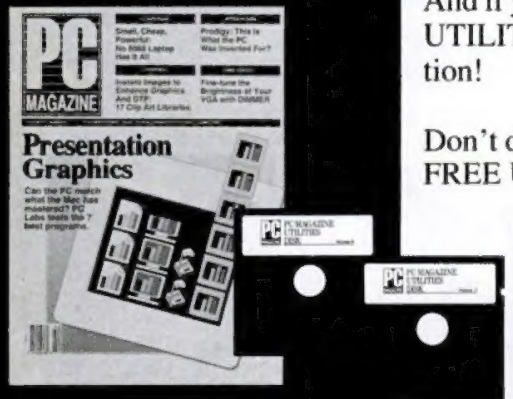

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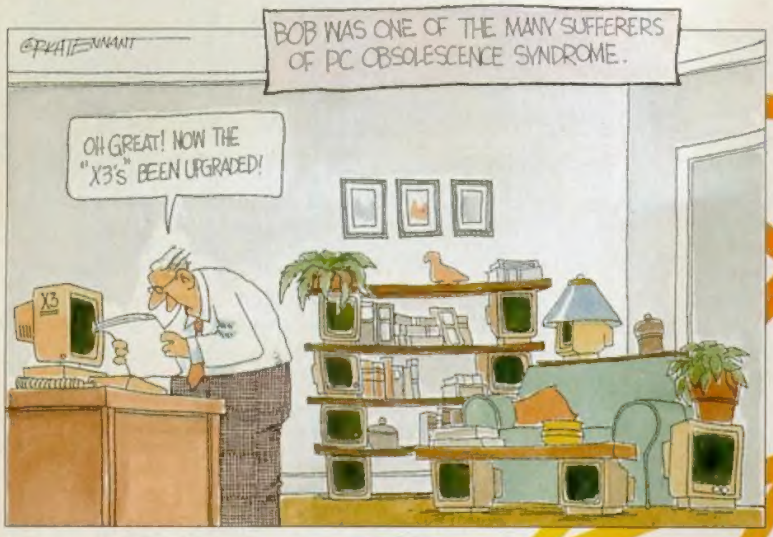
by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing



Pillage, burn, eliminate files

MECHWARRIOR

MechWarrior brings the sizzling action of FASA's BattleTech game system to the PC screen. You're the pilot of the galaxy's most fearsome weapon: the BattleMech manned robot. You're also the commander of a four-Mech team. You see the battlefield in a heads-up display done in 3D

Here's a game you'll want to play on a floppy-drive-only PC: *MechWarrior* from Activision, as described in a MicroWarehouse advertisement.

Notes from the Police Blotter

"A computer, a printer, a cursor and an ink jet-printer were stolen from a business in the 4100 block of Rio Bravo."
—*Westside Today* (El Paso, Texas), February 1, 1990

Connie Wheat works on a computer terminal for Blue Cross/Blue Shield of New Jersey in the sewing room of her Flanders home.

This, according to the *Daily* (Morris County, New Jersey) *Record* (January 28, 1990), is a computer terminal.

Virus Tips I: Back Up Your Hardware

"'What generally happens is someone gets a freebie software package from a brother, sister or cousin, and it's infected,' said Gane. 'It infects another machine and they do it unknowingly,' he said. 'Viruses are spread through touching. We don't let people touch all parts of the system, so there's sort of a bumper there,' he said. Orrick and Gane suggest the only way to be prepared for a computer virus is to make copies of all hardware and software. This acts as a backup and helps restore lost data."
The Loyalist Pioneer (Loyalist College, Belleville, Ontario), January 15, 1990

"Sorry, I'm a Little Short, Today. Would You Give Me $5 Worth of COMMAND.COM and Check the Oil, Please?"

"Because DOS serves as the link between WordPerfect and your computer, we say WordPerfect runs under DOS. It is important to remember, however, that DOS software is not manufactured by WordPerfect Corporation. WordPerfect and DOS are two entirely different software products. You can start your machine with a WordPerfect diskette only if enough DOS has been copied onto it."
—*WordPerfect* 5.1 manual, page 159

Virus Tips II: If You Can't Abstain ...

"The best protection, of course, is to avoid viruses in the first place—a process akin to safe sex. Abstaining from new software is the most effective approach. If a user can't resist, he should minimize contact with possible carriers (floppy disks from friends, user groups, unfamiliar bulletin boards or data banks). A write-protect tab (which functions like a condom) can be placed on all floppy disks inserted in the machine, so they can't catch an infection."
The Washington Post, January 14, 1990

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of the entry are considered. Winners this issue: Steven Lord (calculator computer), John Trupkiewicz (pillage, burn, eliminate files), Doug Couture (virus tips: hardware backup), Chris Norloff (virus tips: safe sex), R.A. Mendoza (stolen cursor), George Hulse (enough DOS).

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